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ELECTRICITY IN THE STONE INDUSTRY.

The utilization of hydroelectric energy for special industries has in late years been growing rapidly. This is, indeed, natural since some of the first energy transmission of any kind was for utilization by particular manufacturing plants. As a rule transmission systems for such purposes are rather commonplace in their engineering design and methods, but in the current issue there is described a hydroelectric transmission system which is altogether unusual, if not at the generating end at least in the final distributing end. It is a plant designed particularly to distribute energy to the important Bedford limestone district in Indiana from which comes so large an amount of valuable building stone. This particular kind of quarrying is one which lends itself very readily to the application of electric energy. When recently exposed the stone is soft and can be cut with the greatest ease by channeling machines. Electric derricks and hoists are then utilized to deposit the blocks in the stoneyard, and thence they are placed on the cars by electric traveling cranes. During the yearly period of greatest activity many of the rock saws are in use twenty-four hours per day, so that except for the three winter months the load on the system is both large and fairly steady.

The development in question is being made by the Southern Indiana Company with special reference to the Bedford stone industry. Bedford is fortunately within 10 miles of available water-power on White River, and within a radius of 3 miles of the substation at Bedford are fifteen quarries and thirty-five mills, so that the transmission distance is really a short one and the load is an ample one to make the transmission scheme worth while. The hydroelectric plant is rather typical of developments in the Middle West. It utilizes a comparatively low head of only 17 ft., and the water supply during some three months of the year is scarcely sufficient for the development intended. It has, therefore, been necessary to equip an auxiliary steam plant to take over part of the load during the period of low water. Ordinarily such a plant would be placed at or near the substation, but in this case condensing water was not readily available at that point and, the transmission line being a short one, the auxiliary plant has been combined with the water-power station, the losses in the short transmission system being much less worth considering than the loss due to absence of proper condensing facilities. The steam plant, consisting initially of two 750-kw horizontal turbo-generators, was first installed to meet the pressing requirements of the quarries for energy, so that transmitted energy is available for this season. The water-power plant now being completed is being equipped with five 1000-kva vertical units operating at 128 r.p.m. Generators are wound for 2300 volts, but the transmission pressure is 22,000 volts. The plant is fitted with the usual remote-control switchboard apparatus, but is so specialized that both the steam and electric plants are completely controlled from the same board, so that the operator after starting up any steam or water-driven unit can synchronize it from the board and control the whole plant completely without leaving his place.

The transmission line itself consists of duplicate three-phase circuits carried on steel towers spaced 300 ft. apart. The tower line is not, therefore, of extreme design. The towers themselves are 35 ft. in height above the ground and the spacing very conservative. It therefore occupies an intermediate position between a steel-pole line and the ordinary long-span tower line, a compromise which is probably a useful and an economical one. The energy transmitted at 22,000 volts reaches the substation at Bedford, with only one diversion on the way, and is thence distributed to the stone quarries. The distributing circuits are operated at 2200 volts with star connection, so that the pressure between lines in the secondary is 3800 volts. The neutral points of these circuits are well grounded at both the substation and the feeding points. Provision is made for motor-generator sets in case it is desirable to deliver direct current to some installations in the neighborhood. The application of motors to the quarry work is now highly specialized, so that a very large amount of labor in cutting and delivering stone can now be handled by electricity. There is a total of nearly 13,000 hp in motor-driven apparatus in the Bedford district, and even this large amount is likely to be considerably exceeded in the near future, since the Bedford stone industry is a thriving one and the advantages of cheap electric energy are keenly appreciated.

THE ENGINEER AS A CITIZEN.

There have recently been many very gratifying indications that engineers are awaking more completely to a realization of their importance in the solution of public problems in the communities in which they live. In years past there has been too much tendency on the part of the average citizen, and even on the part of the engineer himself, to look upon the engineer as merely a convenient accessory to the carrying on of large public enterprises. However, the increasing number of engineers in important executive positions has demonstrated that engineering training and methods of analysis of various problems are almost necessary in great public enterprises. The engineer of the past has perhaps too frequently secluded himself with his technical problems, leaving the broader executive matters to others less fitted by training to cope with them. In fact, there has been an outspoken aversion on the part of some engineers to becoming business men as well as engineers. The talk of "engineering for engineering's sake" is on a parallel with the sentiment among certain institutions of learning of "science for science's sake" and "learning for learning's sake." It is undoubtedly desirable that some such sentiment exist in order to foster the spirit of scientific investigation free from ideas of commercial gain. There must always be the pioneer in scientific work who blazes the trail for the more commercial engineer. Going a step further from pure science, there must always be the highly technical engineer to point the way to the engineering executive or business man. However, it is a serious mistake for engineers to ignore or belittle the importance of the engineering executive man who knows how to bring together the efforts of various engineering specialists in any large undertaking. So much of our modern life depends on engineering achievements that the numerous addresses delivered during the past two years before various engineering bodies as to the part which the engineer should take in civic affairs are certainly commendable. A more complete realization of these things a number of years ago would undoubtedly have put engineers in many positions which are to-day being filled by lawyers and business men without special training and which might better be filled by men from the engineering ranks.

AN IMPROVED FORM OF PRONY BRAKE.

The well-known general type of power-absorption brake for measuring the output from prime movers, called a prony brake, is attributed to the celebrated French engineer of that surname. It is just as well, perhaps, that only the surname is applied to the device, because his full name was Gaspard Clair François Marie Riche de Prony, who lived from 1755 to 1839. The prony brake, as applied to measuring the power of motors, has taken a variety of forms in detail. The principal idea running through all of them is that the load torque applied to the machine under test shall be susceptible of adjustment as well as measurement. It is desirable, moreover, that the application of the brake to the motor shall apply no appreciable stresses other than the measured load torque. The product of this torque into the speed of rotation of the motor, in appropriate units, gives immediately the output of the machine in watts absorbed by the brake. Except in the cases of the smallest machines the power absorbed by a prony brake brings the heat-dissipating power of the apparatus to a severe test and means have to be provided to keep the motor and brake cool.

The particular design of prony brake described by Mr. H. G. Crane in this issue possesses some very noteworthy and convenient features. It is very portable and can be easily transferred from one machine to another, a property that is especially desirable in a classroom laboratory. There are very few parts to get out of order, and the device may lie out of use for many months without becoming deranged. The principal novel features of the design, however, lie in using a spring balance for the tension indicator, a convenience which is rendered possible by the use of a dashpot, and also in the insertion of a tightening screw into the beam, so located that pressure of the hand exerts no component of torque about the motor shaft and, therefore, introduces no error into the measurement. Those who are familiar with mechanical appliances of this kind know how much of satisfaction and convenience depend upon details in design that at first sight appear of small moment. There are various details of this kind in Mr. Crane's design that will commend themselves to the man who applies prony-brake tests in factory or laboratory.

OVER-SPECIALIZATION IN EDUCATION.

Epigrams exhibit sometimes cleverness in phrasing rather than the exact expression of a truth. To some extent this may be the case with the dictum that education consists in knowing "something about everything and everything about something." Nevertheless it is true that the really well-educated man must combine broad general knowledge with exact and detailed information relating to his own specialty. The words quoted carry this idea in a form that is somewhat exaggerated for sententious expression. But the underlying idea is one that must be accepted, and to no class of men is the truth sought to be conveyed more important than to engineers, including electrical engineers, who evince a tendency to become lop-sided in their intellectual development owing to intensive cultivation of engineering knowledge to the neglect of general culture.

The subject is recalled to mind by the address of the Right Hon. James Bryce, British Ambassador to the United States,

at the recent anniversary celebration of Johns Hopkins University in Baltimore. The distinguished speaker dwelt on the conflict of modern specialization with the general culture needed for a liberal education. He showed how absorbing scientific studies become, and said that the problem of modern university education is how to find time for specialized studies and also for a survey and comprehension of the general field of human knowledge, which is so necessary in order to make the university graduate capable of seeing the relation of his own particular study to others, and of appreciating the various methods by which discovery is prosecuted. "A university," said Dr. Bryce, "has to think not only of forming specialists, but of making these specialists better by giving them a wide range of knowledge, and still more of sending out men who sustain the level of taste and insight in the whole community and are fit to be its intellectual leaders."

How do these words apply to electrical engineering education? Is a place accorded our electrical engineers among the intellectual leaders of the community commensurate with the value of their share of the world's work? If not, is not the fact due largely to a neglect of cultural studies in college and to a consequent lack in after life of a broad, intelligent interest in all the avenues through which humanity marches forward in its stumbling, halting, but unfailing progress? Do we make presidents, ambassadors, governors, senators, representatives, great administrators, of engineers? Possibly the engineers are not ambitious for places of honor in the state. They may be content to see others fill these positions if let alone to do their work, but it may be that this very tendency is an indication of a defect in education; for what work can be more important than that which has to do with the common welfare of all? After all, men are more important than things. Perhaps engineers as a class are too much interested in the forces and elements of nature and too little in the general advancement of human society. All men who work must specialize, of course, but none of us should forget, as engineers are particularly prone to forget, that the greatest study of mankind is man.

VISUAL ACUITY.

The human eye is both an optical instrument and a physiological organ. It has apparently been slowly developed, under the laws of Nature, by time under the conjoint influences of constant radiation stimulus from without and constant adaptive selection from within. The origin of the eye as a sense organ in all probability took place in our remote ancestors in the form of a primitive sensitive spot on the otherwise undifferentiated skin. This spot connected itself with the nervous system of the organism through a few specialized fibers and the latter conveyed stimuli of radiant energy or light falling on the skin. There are still on our world creatures possessing no higher development of the eye than this. Gradually development occurred in this piece of sensitive skin, either through accidental variations of strength leading to a survival of the happy fortuitous possessor in the struggle for existence or through the more intense physiological reactions that such accidental improvements set up. After immense ages of time and selection of animal races in the automatic self-assertion of nerve tissue the eye became a highly mobile sensitive optical mechanism, and the brain came down to unfold itself on its inner surface. The retina is actually regarded anatomically as an elongated extension of the brain substance. It is no wonder, therefore, that the external aspect of the eye should furnish a rough indication as to the nature and activity of the mental processes of the individual possessor.

This wonderful retina of the eye is virtually a layer of nerve tissue abundantly nourished by blood vessels. The sensory organs, called from their microscopic appearance the rods and cones, lie at the bottom of the layer. Above them lie nerve ganglia and interconnecting nerve fibers. Above these lie the filaments of the optic nerve, like a mesh of transparent conducting wires insulated in glass tubelets and a network of arterioles, veinlets and capillaries. The shadows of these blood vessels are constantly projected down upon the layer of rods and cones at the bottom, except at the fovea, or central sensitive spot, where the blood vessels do not obtrude. Although microscopists tell us that there is no direct simple nervous connection between the fibers of the optic nerve and the rods and cones—that is, each rod and cone connects with certain ganglia, which in their turn connect with particular fibers of the optic nerve—yet it would seem that each ultimate elementary visual impression requires to be received on an individual rod or a cone, and the ordinary picture of the outer world presented to an observer by the eye is a summation stimulus effect of a very great number of individual stimuli received by these minute terminal sense organs. In order that the image-picture presented to the mind shall be clear it is essential that the retinal structure shall be normal, its physiological activity vigorous and the optical image of the object viewed sharply focused on the retina with suitable luminous intensity. Visual acuity, or the sharpness of visual perception, depends on all of these conditions.

Strictly speaking, there are several meanings that may be covered by the term acuity. It may refer to the sharpness with which two separate objects in close proximity can be distinguished, as, for instance, two companion stars in a telescopic field. Again, it may refer to the sharpness with which the outlines of small objects can be distinguished and recognized, as when we try to read a standard size of type on a printed page at a distance. Again, it may refer to the luminous contrast necessary between a certain portion of the visible field and the remainder, or background, in order that the difference in their illumination may be appreciable, as when a setting is made with a Lummer-Brodhun concentric-field photometer. In all these cases, however, there are included jointly in the examination a test of the optical power of the eye, its sensory capability and the judgment mentally made by the subject who interprets his impressions. The two latter meanings of the term acuity are discussed in an article by Mr. Sydney W. Ashe in this issue. It would seem that the test for acuity which depends upon the distance at which a certain size of type can be read is rather crude, even allowing for the degree of illumination, and that for the purposes of laboratory investigations a more precise test might be devised. At the same time it must be recognized that this test has been evolved by oculists after many years of trial, and that, while it leaves room for improvement in examining the eyes of trained observers, yet it meets the needs of practice in professional dealings with the public at large. If in the use of this printed-type test the acuity of the eye examined is seriously defective the defect is very speedily detected, and the only question outstanding is whether the defect lies in the optical arrangements of the eye or in the nervous mechanism which the eye, as an optical instrument, subserves.

Supreme Court Standard Oil Decision.

On Monday the United States Supreme Court handed down an opinion affirming the decree of a lower court adjudging the Standard Oil Company a combination in restraint of trade and ordering its dissolution. The Supreme Court, however, extends the period of reorganization of the company from thirty days, as set by the lower court, to six months. The labor of the court in passing on the case is illustrated in the opinion by the statement that the record placed before it consisted of twenty-three volumes of printed matter aggregating about 12,000 pages.

The opinion gives the following résumé of the charges in the suit against the Standard Oil Company:

"Rebates, preferences and other discriminating practices in favor of the combination by railroad companies; restraint and monopolization by control of pipe lines, and unfair practices against competing pipe lines; contracts with competitors in restraint of trade; unfair methods of competition, such as local price-cutting at the points where necessary to suppress competition; espionage of competitors, the operation of bogus independent companies, and the payment of rebates on oil, with the like intent; the division of the United States into districts and the limiting of the operations of the various subsidiary corporations to such districts, so that competition in the sale of petroleum products between such corporations had been entirely eliminated and destroyed; and finally reference was made to what were alleged to be the 'enormous and unreasonable profits' earned by the Standard Oil Trust and the Standard Oil Company as a result of the alleged monopoly."

While the opinion sustains the judgment of the lower court in the present case, it lays down the principle that the Sherman anti-trust act applies only to contracts and combinations that unreasonably or unduly restrain interstate trade or which are unreasonably restrictive of competitive conditions, and that the criterion to be applied is the direct or indirect effect of the acts involved. "Although the statute by the comprehensiveness of the enumerations embodied in both the first and second sections makes it assiduously certain that its purpose was to prevent undue restraints of every kind and nature, nevertheless, by the omission of any direct prohibition against monopoly in the concrete, it indicates a consciousness that the freedom of the individual right to contract when not unduly or improperly exercised was the most efficacious means for the prevention of monopoly, since the operation of centrifugal and centripetal forces resulting from the right freely to contract was the means by which monopoly would be inevitably prevented if no extraneous or sovereign power imposed it, and no right to make unlawful contracts having a monopolistic tendency were permitted." In a dissenting opinion, Justice Harlan vigorously took issue with the limitation by the court of the Sherman act, which he characterized as judicial legislation, and held that the construction previously put upon the act by the court had recognized its application to every contract which restrained commerce and trade.

The first and second sections of the Sherman anti-trust act are the ones into which the opinion enters at greatest length. The first section declares illegal "every contract or combination, in the form of trust or otherwise, or conspiracy in restraint of trade or commerce among the several states or with foreign countries." The second section declares to be guilty of a misdemeanor "every person who shall monopolize or attempt to monopolize, or combine or conspire with any other person or persons to monopolize, any part of the trade or commerce between the several states or with foreign countries." The court stated that undoubtedly the word "monopolize" as used in the section reached every act bringing about the prohibited result, and the ambiguity, if any, is involved in determining what is intended by monopolization. "This ambiguity, however, is dispelled in the light of the previous history of restraint of trade. Having in this section forbidden all means of monopolizing trade—that is, unduly restraining it by means of any contract, combination, etc.—the second section seeks, if possible, to make the prohibitions of the act all the more complete by embracing all attempts to reach the end prohibited by the first section—that is, restraint of trade by any attempt to monopolize or at monopolization thereof, even though the acts by which such results are attempted to be brought about, or are brought about, are not embraced within the general enumerations of the first section.

"Since, however, the acts which may come under classes stated in the first section, and the restraint of trade to which that section applies, are not specifically enumerated or defined, it is obvious that judgment must in every case be called into play in order to determine whether a particular act is embraced within the statutory classes, and whether, if the act is within such classes, its nature and effect cause it to be restraint of trade within the intent of the act. To hold to the contrary, the statute would be destructive of all right to contract and agreement to combine in any respect whatever as to the subjects embraced in restraint of trade or commerce. There is room left but for one conclusion, which is that the statute was expressly designed not to limit unduly the application of the act by precise definition, but while clearly fixing a standard—that is, by defining the ulterior boundaries which could not be transgressed with impunity—to leave it to be determined by the light of reason, guided by the principles of law and the duty to apply and enforce the public policy embodied in the statute, in every given case whether any particular act or contract was within the contemplation of the statute. In every case where it is claimed that an act or acts are in violation of the statute, the rule of reason, in the light of the principles involved and of the public policy which the act embodies, must be applied."

Taking up the charges against the Standard Oil Company, the opinion states that no disinterested mind can survey the evolution of the company without being irresistibly driven to the conclusion that the very genius for commercial development in organization, which it would seem was manifested from the beginning, soon begot an intent and purpose to exclude others, which was frequently manifested by acts and dealings wholly inconsistent with the theory that they were made with the single conception of advancing the development of business powers by usual methods, but which on the contrary necessarily involved the intent to drive others from the field and to exclude them from their right to trade.

The acquisition which ensued of every efficient means by which competition could have been asserted, the slow but resistless methods which followed by use of which the means of transportation were absorbed and brought under control, the system of marketing which was adopted by which a company was divided into districts and the trade in each district was turned over to a designated corporation within the combination, lead the mind up to a conviction of the purpose and intent which is so certain as practically to cause the subject not to be within the domains of reasonable contention. The various acts of the company give rise to a prima facie presumption of intent and purpose to maintain a dominancy over the oil industry, not as the result of normal methods of industrial development, but by new means of combination which were resorted to in order that greater power might be added than would otherwise have arisen had normal methods been followed, and wholly with the purpose of excluding others from the trade and thus centralizing in the combination the perpetual control of petroleum and its products in the channels of interstate commerce.

Referring to contentions that if the lower court is upheld the company could not conduct its business under jeopardy of punishment for contempt, and that the restraint imposed by the decision was calculated to do injury to the public, and similar expressions of fear, the court replied that the decree was construed not as depriving the stockholders or corporations of the right to live under the law of the land, but as compelling obedience to that law. The decree, therefore, is not amenable to the criticisms directed against it, and cannot produce the harmful results which had been predicted as sure to follow its affirmation.

N. E. L. A. News.

In view of the nearness of the annual convention of the National Electric Light Association in New York City, May 29 to June 3, it is but natural that the activities of the various committees should assume definite shape. The attendance it is expected will be the largest yet recorded, and in order that the work of the convention may move smoothly every precaution has been taken to avoid confusion. The various New York companies on which will fall the brunt of the entertaining have provided lavishly, and the entertainment features have been so timed that they will not conflict with regular sessions. For the convenience of those who are attending a certain session and who may wish to be present when a certain report or paper is being read or discussed at another session being held simultaneously, announcement boards will be provided on which will be posted the topic being considered in each meeting-room. There have been some changes in the list of theaters, necessitated by closed seasons or theatrical contracts. The three theaters available for the membership and guests on June 1 are the Broadway, Winter Garden and Herald Square. The Lyric may be substituted for the last theater before the arrangements are definitely settled.

EXECUTIVE.

At a meeting of the executive committee of the National Electric Light Association held in New York May 11 the report of the secretary showed the organization to be in a most flourishing condition. Over 1800 new members were admitted, making the net gain since the last meeting, held two months ago, over 1600. The association has about $40,000 in cash and se urities and no outstanding debts. The membership at the present time has reached 8100.

The sub-committee, of which Vice-president J. F. Gilchrist, of Chicago, is chairman, reported on its trip to the Pacific Coast to inspect the various cities and their facilities with regard to the proposed convention of 1912. After a hearing and discussion of the report of the committee it was unanimously decided to hold the next convention at Seattle, Wash., probably about the beginning of June. It was stated that there is keen interest in the subject along the Pacific Coast and that the trip will undoubtedly result in a large increase in membership in that section, together with a deeper interest in the work of the association.

Mr. E. J. Allegaert, on behalf of the committee on uniform accounting, submitted a report in favor of a system of interchange of accounts among the member companies; the adoption of a standard set of forms adapted to the association's standard classification of accounts, to be distributed to the members, and the advocacy of the adoption of the standard classification by public-service commissions that have not yet acted upon such a matter, and where and when new public-service commissions are created.

CONVENTION NOTES.

The registration for the coming convention has already reached about 2000, which would indicate an actual attendance of at least 4000. The association has secured additional facilities in the Engineering Societies Building by means of which it will be possible to spread out the throng over several floors. On the ground floor the ingenious idea has been adopted of supplementing the foyer by inclosing the large driveway around the building, so that the members can also sit and lounge in the open air. This driveway around both sides and the rear of the building will be made to simulate a vine-clad arbor, and the walk will be covered with crash or carpet. The arbor will be lighted by electricity, and seats will be provided so that members may promenade or lounge about, as desired. The large room back of the foyer has been reserved for the transportation committee, and at the east side of the foyer will be the booths for the registration of delegates and distribution of papers. The office of the *Convention Daily* will be in the directors' room on the mezzanine floor. The largest three meeting rooms will be devoted to the regular sessions, and on the floor above another meeting room has been provided as headquarters for the various state sections, the Sons of Jove and other affiliated or auxiliary bodies applying for such accommodations. The exhibition committee will also have its headquarters on this floor, and the sub-committee on theaters, which will distribute the tickets for the three theaters which have been engaged for Thursday evening of convention week.

The public-policy meeting will be held Wednesday, May 31, at the New Theater, when Secretary Nagel, of the Department of Commerce and Labor, will represent President Taft and deliver an address. The public-policy report will be presented by Past-president Samuel Insull. It is proposed also to make this meeting at the New Theater a notable musical affair, as the orchestra of the New Theater, under Dr. Elliott Schenck, has been retained to render a selection of notable musical successes of the season. The New Theater is the finest playhouse in New York City. It may be noted incidentally that instead of the proposed morning concert for the ladies during the week a performance is to be given by the Miniature Company in the play "Pomander Walk." This company is composed entirely of children, and the performance is said to be excellent.

The baseball game will take place on Wednesday afternoon, May 31, at the baseball grounds in Brooklyn, which are very accessible from headquarters. The competing teams will be those of the Brooklyn and Philadelphia Edison companies.

The regular meetings have been arranged to occupy sixteen sessions, extending through Tuesday, Wednesday, Thursday and Friday, while the program of the last day is perhaps the best of all four days and will command the attention of the members up to the last moment. The final program will be published in these columns next week.

COMMERCIAL SECTION NEWS.

The present membership of the Commercial Section, as nearly as can be ascertained, is 658, although new applications are received daily. It is the ambition of the membership committee to reach the 1000 mark if possible before the convention, as there are a sufficient number of eligible persons to bring the roster up to that number without undue urging. The reports of the various commercial committees promise to be most interesting and valuable. The "power" committee has been working assiduously on the compilation of data relative to "power" conditions in the different sections of the country, and a long list of machinery, together with the horse-power of motors required to drive it, has been got up.

The ornamental-street-lighting committee has collected information from the central stations throughout the country, so that its report should be of inestimable value to the members of the commercial section.

A number of interesting features will be embodied in the report of the residence-business committee, including plans and blueprints showing a complete scheme of wiring recommended for residences, for small motors and electric heating, as well as for lighting, together with plans and recommendations for keeping account of this business.

The committee on electricity in rural districts will present a large number of illustrations showing the various applications of electricity in farming communities.

The sign committee has prepared a bulletin which, it is said, will form an agreeable surprise to members of the section. The advertising committee has some important propositions to bring before the section regarding the exchange of central-station advertising.

SONS OF JOVE REJUVENATION.

Friday, June 2, will be known as Jovian night. The rejuvenation will be national in scope and character and will be preceded by a dinner at which approximately 1000 Jovians, including many of the national officers, are expected. The dinner will be held at 6 o'clock in the great ballroom at Dreamland Park, Coney Island, and will be presided over by Jupiter. The rejuvenation will be conducted by the national officers in full regalia. The regular business sessions of the convention coming to a close on Friday, it is expected that the rejuvenation will be most successful.

Presentation of Willard Gibbs Medal to Dr. Arrhenius.

An event of unusual interest to scientific men took place in Chicago on May 12 when the Willard Gibbs gold medal of the Chicago Section of the American Chemical Society was presented to Dr. Svante Arrhenius, of Stockholm. Dr. Arrhenius, who is president of the Nobel Physical Institute in Stockholm, is about to return to Sweden after a sojourn in this country, during which he has delivered a number of lectures before colleges and learned societies. The Chicago Section of the American Chemical Society took advantage of the occasion to make the award. The Willard Gibbs medal was established by Mr. William A. Converse, former president of the Chicago Section, who stipulated that it should not bear his name. It is named in honor of the late Prof. Willard Gibbs, of Yale University, whose work in science is well known. The medal is given annually to someone who is distinguished for an original contribution to pure or applied chemistry on condition that the recipient deliver an address before the Chicago Section at its May meeting. Dr. Arrhenius took for the subject of his address on May 12 "Electrolytic Dissociation."

The presentation was made in the course of a banquet at which Mr. S. T. Mather, chairman of the Chicago Section, presided. This gathering was held in the Gold Room of the Congress Hotel and was a brilliant and enthusiastic affair attended by perhaps 250 ladies and gentlemen. The first speaker was Dr. Harry Pratt Judson, president of the University of Chicago, who in welcoming the guest of the evening dwelt on the fact that science knows no nationality. Mr. Harry A. Wheeler, president of the Chicago Association of Commerce, spoke of the relation of science and industry and made the epigram that science plus capital equals commerce. The toastmaster then related the circumstances connected with the origin of the Willard Gibbs medal and remarked that Professor Arrhenius is the first recipient of this medal.

Prof. Alexander Smith, president of the American Chemical Society, made the presentation. He briefly recounted some of the events in Dr. Arrhenius' career. He said that the thesis contributed in 1884 by Professor Arrhenius for the degree of Ph.D. contained the fundamental ideas of the hypothesis of electrolytic dissociation, with which the name of the guest of the evening is indissolubly connected. The appearance of this theory marked an era in the science of chemistry. Professor Smith briefly sketched some of Dr. Arrhenius' other contributions to science, including electricity, and in handing the medal to the guest of the evening remarked that the latter had united the chemists of all nations in admiration of his work, and that he was a man like Faraday, Gibbs and Mendeleef.

In responding, Dr. Arrhenius spoke in English without the aid of manuscript. He paid a tribute to Willard Gibbs and coupled the name of Gibbs with that of Helmholtz, the greatest mathematical physicist of his time. It is a great honor, he said, to be associated with the name of Willard Gibbs, and the speaker said that he was deeply touched by this honor, which he appreciated greatly. He then proceeded to give some account of his discovery of the law of electrolytic dissociation, going rather deeply into the chemistry of the subject. He spoke of the early work of Gay-Lussac, Clausius, Williamson and others, and remarked that the idea of dissociation, supplanting the old atomic theory, was almost impossible to believe when first broached. He described his studies in the conductivity of solutions and said that his own "great luck" was that he investigated the most dilute solutions. He found that the molecules that are active in relation to electricity are also active in relation to chemical energy. He told how he wrote to Ostwald and others, and described, often with amusing side remarks that revealed a keen sense of humor, the incredulity of scientific men when his theory was first presented to the world. He related how the new theory fought its way and was accepted, and said that the theory of electrolytic dissociation has now been brought to completeness and accounts for many of the phenomena in relation to solutions. Especially in physiology and biology is the theory of great interest. "It is clear," said the speaker, "that biology will be the most practical science of the coming time. It has to do with life, and we are all living beings." In conclusion the recipient of the medal spoke of the importance of the practical applications of science and praised the practical side of the American character. He expressed the hope that many other members of the society, of which Dr. Arrhenius himself is a member, would receive the medal in coming years.

The last speaker was Chief Justice Harry Olson, of the Municipal Court of Chicago, who represented the many Swedish guests who were present. Referring to Professor Arrhenius' connection with the Nobel Institute, Judge Olson suggested that if the proposed Anglo-American arbitration treaty becomes an accomplished fact the name of President Taft might well be suggested for the Nobel prize for peace.

Meeting of Electric Vehicle Club at Boston.

The regular weekly luncheon and meeting of the Electric Vehicle Club of Boston were held at the Edison Building on May 10 with Mr. A. F. Neale, of the Baker Motor Vehicle Company, in the chair. Mr. Day Baker, for the committee on signs, submitted prices and estimates of cost for locations at Mattapan, Chelsea, Dudley Street and Sullivan Square, Boston, covering the installation and yearly operation of electric signs of very large size advertising electric trucks and carriages. In general, the estimated cost of erecting a sign from the ground or roof support varied from $1,500 to $1,800, including the first year's rental of space, the sign being about 25 ft. wide by 35 ft. long. Free energy and maintenance are offered by the Boston Edison Company. Figures were also presented covering a sign 80 ft. long by 52 ft. wide for tentative erection at a point overlooking Boston Harbor, bearing letters from 6 ft. to 10 ft. high. It was estimated that the first year's service of such a sign, including the investment, could be accomplished for less than $3,500. It was estimated that in most cases the cost of service would be in the vicinity of $750 less for the second year for the smaller signs. The matter was referred back to the committee to enable additional figures to be secured, including a consideration of the wisdom of installing at some elevated point a sign of such size that it would be visible at all points in the central Boston area. Mr. W. H. Atkins, general superintendent of the Boston Edison company, pointed out the advisability of certain sign locations on main avenues of automobile travel to and from the shore resorts near Boston.

The question of publicity was discussed at length. Mr. C. Brewer Smith emphasized the advertising supported by the factories producing gasoline machines and urged that every effort be made to secure liberal appropriations from electric-vehicle makers for newspaper publicity. He commended the spirit of co-operation found among Boston agents of vehicle manufacturers, and outlined the course to be followed in forthcoming newspaper insertions. Mr. Atkins offered the Edison company's main show window on Boylston Street for a week for electric-vehicle display with special lighting to bring out points of interest, and a committee was appointed to work out details. The rate committee reported that it is collecting prices in the hope of later effecting a standardization in the cost of charging. Mr. E. S. Mansfield, of the Boston Edison company, exhibited twelve letters of inquiry received during the week as a result of the company's campaign of publicity on behalf of the electric vehicle. It was announced that over fifty electric vehicles will probably be operated in the procession in Boston on May 30 as a contrast to the horse-drawn teams of the annual work-horse parade.

Mr. Atkins called attention to the necessity of providing parking facilities in the Boston business district for ladies, who are at present debarred by the street regulations from bringing their electric carriages down town and letting them stand. He stated that, if some appropriate space can be secured, the Edison company is prepared to furnish a private police officer to keep watch over the cars and make himself useful generally. A committee of one was appointed to look into the situation. A vote of thanks was then passed to the *Electrical World* for its co-opera-

tion in covering the meetings of the club from week to week, after which Mr. W. H. Francis described a recent Western trip in the interest of the electric vehicle, touching upon the excellent work being done at Rochester, Detroit, Cleveland, Chicago, Buffalo, St. Louis and Indianapolis. The greatest interest in the vehicle is where the most care is taken of the cars. Mr. L. R. Wallis, of the Edison company, emphasized the success of the so-called "League Garage" in Detroit under private management, showing that it is unnecessary for a garage to be operated by a central station or a dealer to promote the electric vehicle. Mr. Francis commended the practice of loaning batteries followed by the Fashion Garage of Chicago, and Mr. C. A. White, of the Edison company, reviewed the efforts made by this garage to relieve customers from equipment troubles and particularly to show how simple the electric vehicle actually is. Mr. Atkins offered to enlarge any illustrative matter brought in for display in the Edison company's window, and Mr. Wallis commended a photographic exhibit of the week's sales of one company, which showed the machines lined up in front of the new Museum of Fine Arts, giving an effective background. Mr. Mansfield said that the Edison company is glad to act as a clearing house of information in the electric-vehicle campaign, citing inquiries for a vehicle agent which had lately come to hand. Mr. P. R. Moses stated that the Fall River Electric Light Company is planning to open a public electric-vehicle garage in the near future, the management being desirous of adding to its long-hour business. At a Cotton Centennial to be held on June 19 the company will feature the electric vehicle extensively.

Electric Lighting at "The World in Boston."

In connection with the spectacular features of the "World in Boston" Missionary Exposition, closing on May 20, electricity has been extensively and effectively utilized. The exposition is the first of its kind in America and constitutes an elaborate assembly of missionary data, illustrative material, life-size and model scenes from all the principal countries of the world which are being evangelized, including extensive lectures, moving-picture demonstrations and a "Pageant of Darkness and Light," which is given twice daily with the most dramatic effect. The exposition was opened in the latter part of April by President Taft, who pressed a key at the White House which operated a Western Union telegraph relay in the Pageant Hall of the Mechanics' Building, the relay closing a circuit of twenty-five 4-cp incandescent lamps installed in the form of a cross at the front of the auditorium.

The principal applications of electricity at the exposition are in connection with the lighting of the booths and artificial streets representing the fields of foreign missionary activity in all quarters of the globe; in the stage lighting of the pageant, and in the operation of small motors in connection with moving-picture machines, transparencies and panoramic comments upon specific missionary enterprises. Statistics are graphically portrayed on strips of cardboard driven by motors, the eyes of idols are illuminated by miniature lamps, temples and shrines are economically and safely lighted by electricity with emphasis upon special features of interest, and interrupter flash lighting is used to call attention to the vital statistics of native races. Interest centers on the "Pageant of Darkness and Light," however, which exhibits in a two hours' performance four striking scenes in missionary life in the North, Africa, India and the Hawaiian Islands, including elaborate orchestral and choral accompaniment.

Energy for the pageant service is supplied by a 110-volt direct-current plant located in the basement of the Mechanics' Building, an emergency connection being available with the system of the Edison Electric Illuminating Company of Boston. Two No. 4 copper cables lead from the power plant to a temporary slate switchboard located at the side of the stage, a maximum load of about 660 amp at 110 volts being imposed. Each distribution circuit is separately fused and equipped with a knife switch, and all wiring is covered with circular-loom conduit. Ten spot lamps are installed in the wings and behind the cyclorama upon which the various scenes are painted, four lamps being of the box type without lenses. The stage was wired for the occasion, the available space being ordinarily used as an exhibition platform without theatrical facilities of any particular value. Four rows of border lamps are provided, each being composed of the usual red, white and blue lamps with facilities at the switchboard for independent or combined manipulation. The total number of lamps in the border is 360, all being of the 32-cp size. The same color multiplication is installed in the foot-lamp circuits, with the exception that a double row of white lamps is provided for service at the front of the stage. There are 120 lamps of the 32-cp rating in the foot-lamp service. Gradations in the lighting of the stage are produced by seventeen dimmers, one being installed on each feeder circuit. Spot lamps are used to throw into relief each half of the volunteer choir massed outside the stage at the front end of the auditorium, and the conductor uses an electrically illuminated baton equipped with a tungsten lamp of miniature size and supplied from three cells located on the adjacent floor with flexible cord connection.

Four flaming-arc lamps are employed in the pageant in connection with the production of a sunrise scene in an Indian encampment, supplemented by two open-box lamps located behind the transparency carrying the landscape. Moonlight effects are produced by a spot lamp and transparency, and an automatic shutter is installed to stimulate the effect of rippling water. Two fire logs equipped with three 32-cp half-red incandescent lamps are effectively employed in the Northern scene. In the Far East scene a funeral pyre is displayed, and smoke prepared by chemical action in a tank outside the auditorium is forced out through orifices beneath the pyre by a motor-driven air compressor connected with the tank and outlets by a 2-in. rubber hose about 50-ft. long. By this means the unpleasant odor and heat of the chemical reactions are confined to external quarters opening directly out of doors. In the pyre scene a fire effect is produced by six red lamps of 32-cp rating installed beneath strips of red silk, the latter being blown upward on a framework by two 14-in. fan motors set on the floor at the bottom of the pyre and concealed from the audience by draperies. In the Western scene a volcanic eruption is a feature in which red bridge and foot lamps, the smoke machine, projector lamps and twelve strip lamps under the principal transparency are employed, with a carbon-contact device simulating lightning flashes. The climax of the pageant is a tableau of all the performers and choral staff grouped about a semi-recumbent cross formed in a rock by incandescent lamps of 4 cp, and the performance closes with the tune of "Old Hundred" sung by performers and audience to time given by the electric baton. The entire installation was planned and placed in service under the direction of Mr. P. Sibla, of the Back Bay Stage Lighting Company, Boston, the pageant being under the direction of Messrs. George Pickett, master, and Francis Annersley, assistant floor director.

Additions to New Orleans' Drainage Pumping Systems.

The city of New Orleans on May 8 completed the sale of $7,000,000 of public-improvement bonds, the proceeds of which are to be used in extending the water-supply, sewerage and drainage systems of the city, for which motor-driven pumps are employed. The streets of New Orleans lie below the level of the Mississippi River, so that besides pumping the city water supply all of this liquid as sewage must again be lifted out of the city together with all the water of the semi-tropical storms which break upon the city during certain seasons. The surface-water drainage and the sewage-disposal systems are entirely distinct, although each is equipped with a number of automatic motor-operated lift pumping stations, situated at various points on the drain system, and electrically driven from a central generating station. The waterworks pumps deliver about 25,000,000 gal. per twenty-four hours, motor-driven centrifugal

pumps being used for the low-lift duty. The average annual rainfall over New Orleans' 40-sq. mile area is about 60 in. Except for evaporation this immense quantity of water must be discharged outside the levees by artificial pumping. At present there are seven drainage pumping stations and eight sewage pumping stations. As a result of the new bond issue it will be possible to extend these pumping systems as already planned in accordance with the needs of certain districts of the city. To supply energy for the new pumping load thus created it will be necessary to install 6000 kw or 7000 kw additional rating in steam-turbine capacity at the main waterworks pumping station. Mr. George C. Earl is general superintendent of the water-supply and drainage systems.

Proposed Passenger Subway for Chicago.

Mr. Bion J. Arnold, chief subway engineer for the city of Chicago, is making occasional addresses in that city for the enlightenment of the public in relation to the proposed system of passenger subways, which will undoubtedly be begun in Chicago within a comparatively short time. Recently he addressed the Industrial Club of Chicago, and next day was the guest of the Electric Club at luncheon. On the latter occasion he gave a clear exposition in outline of the proposed subways as recommended in his recent "general statement" report.

Two plans were suggested, but the one recommended would consist, so far as the central business district is concerned, of north-and-south subways at a higher level and east-and-west subways at a lower level, forming ultimately a "gridiron" by means of which a passenger could go from any point in the city to any other point by making one transfer in the downtown district. It is proposed to carry out this plan in various steps. Presumably the city itself will build the subways and lease them to private operating companies. The city has now something over $6,000,000 on hand for this purpose, and by the time it is necessary to begin work on the first step it is probable that the $8,000,000 needed will be in sight. This first step would provide one north-and-south subway through the central district and two east-and-west loop subways, all for surface street railways. The second step would take the elevated railways off the streets in the central business district in a similar manner. Various other steps may be taken after this, if desired, until a very elaborate system, as planned, will have been built, extending as far out to the outskirts of the city as desired.

There will be no grade crossings in the subways. Space is provided for underground public-utility structures in the subsidewalk area, as it will be necessary to take the entire space under the street for the subway. The existence of the network of freight tunnels belonging to the Illinois Tunnel Company under the "downtown" streets of Chicago has made the planning of the proposed new passenger subways difficult. The subways as planned will constitute a comparatively shallow system, both for the high-level and low-level subways. (See *Electrical World*, Feb. 16, 1911, page 410.)

Proposed Rocky Mountain Tunnel in Colorado

A bill is pending in the Legislature of Colorado to provide for the creation of a commission of five members, three of whom shall consist of the Governor, Attorney General and Treasurer of the State. This commission is to be known as the Tunnel Commission, and its purpose is to drive a tunnel under the main range of the Rocky Mountains. One of the civilian members of the commission will be an engineer and he will be the supervising engineer of the project, his salary being not over $5,000 a year. The bill authorizes an issue of State bonds of $4,000,000.

The tunnel, if built, will extend through the base of James Peak, having its eastern portal near the town of Tolland, on the line of the Denver, Northwestern & Pacific Railway, commonly known as the Moffat Road, and its western portal near the town of Arrow, on the same railroad. It will be about four miles long at an altitude of 9000 ft. The tunnel is to accommodate a single-track railway to be operated by steam or electricity, although it is to be supposed that electricity will be the motive power selected. The right to use the tunnel is to be given to the Denver, Northwestern & Pacific Railway Company in consideration of the payment of the principal and interest of the bond issue and the cost of maintaining the tunnel. The right to use the tunnel, however, is not given exclusively to the company named, and others may have the same right upon sharing the obligations. One section of the proposed law provides that the tunnel shall never be used for the diversion of waters from the western to the eastern slope of the continental divide for domestic, irrigation, manufacturing or commercial purposes.

The proposed tunnel will shorten the distance on all transcontinental traffic between Denver and Salt Lake nearly 200 miles, provided the Moffat Road is continued to the latter city. The business men of Denver appear to favor the bill, and among them several electrical men have been active in advocating it. It is provided that if the bill is passed it shall not take effect until approved by the people at a referendum vote. The Moffat Road has been built over the Continental Divide, through which it is proposed to tunnel, but its grades and curves are said to be impracticable for heavy freight traffic.

Schoolhouse Lighting Inspection at Boston.

At a recent meeting of the New England Section of the Illuminating Engineering Society an inspection trip was made to the Montgomery Street Evening High School, Boston, under the guidance of Mr. B. B. Hatch, illuminating engineer of the Boston School Committee, and various types of illumination were examined. Mr. Hatch emphasized to the party the influence of the color treatment of the various schoolrooms upon the quality of lighting, stating that the tinting treatment of a room is often the true cause of complaints lodged against the lamp equipment and arrangement. Dark walls and blackboards are capable of creating an impression of poor lighting, even where the actual foot-candles of illumination on the desks are the same as in rooms where complete satisfaction is expressed with the lighting and where there is little complaint of eye troubles. Something more than the mere amount of light delivered to the work in hand must be considered. If the co-operation of the building authorities in the matter of tint cannot be secured the proper results cannot be had in the classrooms. A properly selected color scheme is good for daylight service and artificial illumination alike. Hand-painted buff window shades of duck or canvas have given excellent results at Boston, but the shades must be drawn in the evening in order to get the full benefits of the illumination.

Mr. Hatch stated that in his opinion the blackboard equipment furnishes sufficient relief for the eye in lighter tinted rooms. The use of 60-watt tungsten lamps with prismatic shades about 11 ft. above the floor, the lamps being placed off center with respect to the axis of the room, has given good results with buff trimmings. Placing the lamps off center and using nine lamps in an ordinary 28-ft. x 32-ft. schoolroom provides amply for the scholars in the rear seats. Cheerfulness in the lighting of the front of the room has much to do with the satisfaction of the occupants. In some cases the lighting is subdivided so that the teacher may work after hours without using the entire equipment of the room, and in other cases the dark side of the room is provided with a switch by which it ean be cut in during the winter months. Mr. Hatch severely criticised the use of a system of indirect lighting consisting of a Nernst lamp and four 25-watt tungsten lamps arranged to throw the light upon the ceiling before it is diffused through the room. There are about twenty-seven schoolhouses in Boston in which indirect lighting is used. Glass tops are provided to protect the indirect

fixtures, but it is almost impossible to keep the apparatus free from dust. When the fixtures were installed every janitor was given a long-handled duster for use on the equipment, but on account of the absence of a tight fit between the horizontal glass plate at the top of the lighting units the maintenance of clean shades has been extremely difficult. Drawing the window shades benefited the first row of desks about 10 per cent in foot-candles and the second row about 6 per cent.

Taking up the question of color values in schoolroom decoration, Mr. Hatch pointed out that the most recently finished buildings are about like antique oak. Lighter tones are gradually getting into service. Ordinarily the ceiling coloring does not affect the eye to any great extent, but in a ceiling containing blue coloring or if the cold-water paint borders on the blue-white, a poorer quality of lighting results than would be the case if cream-white were used. Even the old white ceilings that were left just as the skin coat came out had a tendency to throw back a little blue. Poor results had been obtained from rooms painted a dark olive green upon the design and recommendation of the Civic Art League of Boston. That organization proceeded on the basis of securing harmony of dadoes, tiles, etc., and numerous complaints have resulted from the users of the rooms thus painted. A fair result is obtained from the indirect lighting when the glassware is clean and the lamps are new, with a white or cream-colored ceiling, but trouble soon comes from the lack of proper cleaning facilities. The Boston system of compensating janitors may also be influential, since this is on a piece-work basis with assistants employed by the janitors themselves. Most of the new systems of lighting have been installed for the purpose of improving the illumination of the older buildings. New lighting to cost about $6,000 is now being installed in old buildings, and there is need of much larger expenditures for modernization.

Illumination in Cotton Mills.

In a paper presented by Mr. J. S. Codman, of Boston, Mass., before the recent annual meeting of the National Association of Cotton Manufacturers held at the Massachusetts Institute of Technology, Boston, the question of artificial illumination in cotton mills is discussed. The author confines himself to one problem, the lighting of plain-weave looms, and in the discussion of this subject shows to what extent the dimensions of looms are standardized as well as the arrangement of looms in the weave shed. The most annoying shadow which will be obtained if the sources of light are not correctly placed in looms of this type is the shadow of the hand rail on the warp toward the front of the loom. If this shadow exists, the point of passage of the warp thread through the dents of the reed is in comparative darkness, making it difficult for the weaver to draw the threads through when they break. This shadow will always exist if the preponderance of light comes from the rear of the loom, and therefore, in order to avoid it, it is necessary to place the light sources at the front of the loom—that is, in all the weavers' alleys—and in actual practice this is usually done.

If the light sources in the alleys are placed high enough no lamps will be required at the rear of the looms. One other shadow which is likely to be objectionable is the shadow of the weaver's body. With lamps arranged in the alley opposite the center of each loom this shadow is sure to be objectionable because the weaver reaches from the front part of the loom to the rear, under the arch and over the harnesses, and then draws the thread through the harness and reed so that he cannot avoid his own shadow except when working well to the left of the center of the loom. When at all to the right of the center of the loom the weaver will, on account of his position with his left shoulder forward, cast the shadow of his body on the part of the loom he wishes most particularly to see. If, however, the lamps are arranged symmetrically with regard to the looms—that is, at the point of intersection of the two diagonals drawn through the oblong or square section formed by four looms—this objectionable shadow of the weaver's body will be avoided. Good results cannot be obtained, however, unless the light sources are placed at the correct height and correct light distribution obtains.

The general arrangement for satisfactory illumination thus becomes as follows: Light sources should be placed in the weavers' alleys in order that the preponderance of light may come from the front, and they should be so spaced as to avoid any of them coming between looms. Moreover, the light sources should be hung at such a height and have such a characteristic light distribution that the illumination due to the light source at the left of the weaver should be as nearly as possible the same as the illumination due to the light source at the right of the weaver, so that when the light from one lamp is blocked by the weaver's body not more than one-half of the direct light will be cut off. With reference to the number of light sources, the author states that these should be as few as is compatible with good illumination. Two plans are proposed, and a greater part of the paper is devoted to the study of these.

In one, three light sources are allotted in the alley to eight looms, and in the other, two light sources, the only difference being that in the second plan the middle light source is omitted. The light units investigated in the first plan consisted of single clear-bulb tungsten lamps, equipped with various types of reflectors. The reflectors investigated consisted of three clear-glass prismatic reflectors, known as extensive, intensive and focusing respectively, and two opaque-steel reflectors, extensive and intensive. Of the three types of reflectors the focusing was the best suited to the work, and as compared with the glass reflector the steel-extensive type has a decided advantage, and in the direct illumination of the looms is preferable to the former. It is recommended that with this plan 40-watt lamps be used for looms up to and including the 50-in. size and that 60-watt lamps be used for larger sizes. This recommendation applies to coarse gray goods and represents the minimum wattage of lamps to use. With fine dark goods considerably higher wattage may be necessary, but it is not often that larger lamps than 100 watts will be necessary with this arrangement.

In the plan entailing the use of two light sources instead of three, 60-watt tungsten lamps may be used with a similar size of loom and with coarse goods, and where fine dark goods are made it is seldom that lamps of larger size than 150 watts are necessary. The author is of the opinion that the lighting of weave sheds is best accomplished by a considerable number of comparatively low-power lamps, and that the use of large units, such as arc lamps or tungsten lamps consuming 250 watts or more, is not good practice.

Engineering Specifications.

Mr. Frank F. Fowle delivered a lecture on "Engineering Specifications" before the Armour Institute of Technology branch of the American Institute of Electrical Engineers on May 11. Referring to the importance of a knowledge of engineering specifications and business law, the speaker said that it is now recognized that a purely technical preparation cannot fit the engineer for the greatest sphere of usefulness. Of course, purely technical training is fundamental, but at the same time one should not become so absorbed in it as to lose sight of its proper relations to other things in life. The general purpose of a specification is to give an exact, definite description of certain work to be performed in language so clear and precise that there shall be no doubt or uncertainty about the performance of the work. In general the specification forms a part of a contract, and the engineer should have at least an elementary knowledge of the law of contracts. However, the engineer should not usurp the functions of the lawyer nor the lawyer those of the engineer. They should work in collaboration in the matter of contracts and specifications.

Mr. Fowle considered the subject of contracts at some length and then passed to the treatment of specifications. In general every engineering specification treats of two fundamental things

—first, a full, minute and exact description of the work to be done, and, second, the business relations of the parties to the agreement. This presumes that the contract and the specification are parts of one instrument. When this is not the case the specification treats of the work alone. There are three plans of proceeding with the preparation of a specification—first, complete plans in detail; second, general plans only, and, third, no plan whatever. The first is the plan most generally followed. The second may be adopted where stress is laid particularly on the final results or performance. The third method is likely to lead to bad results, and depends for success upon the undoubted ability and integrity of the contractor.

Electrical engineering specifications may be classified as follows:

1. Machinery and equipment.
   - Construction.
   - Delivery.
   - Installation.
   - Performance.
2. Electric wiring.....
   - Inside.
   - Outside.
     - Underground.
     - Aerial.
3. Complete plants.....
   - Light, heat and motor service.
   - Transmission.
   - Railway.
   - Telephony, telegraphy and signaling.
   - Electrochemical.

There are no hard and fast rules in preparing specifications, and the engineer must rely on his judgment and experience. It is a dangerous practice to copy from existing specifications in a blind fashion. A good command of clear English is an important qualification in writing specifications. In general it is best to treat only one feature or requirement in each clause and to dispose of it very completely. It is desirable to place a clause near the opening of a specification stating what drawings, maps, plans, etc., form a part of it.

Mr. Fowle proceeded to make a somewhat detailed analysis of a specification. He considered general clauses and technical clauses and then gave several examples of specifications. These related to rubber-insulated signal wire, a 25-watt dynamotor for operating telegraph lines and a standard underground telephone cable.

In conclusion the lecturer gave the following list of works on business law and contracts in relation to engineering: "Engineering and Architectural Jurisprudence" by John C. Wait; "Law of Operations Preliminary to Construction in Engineering and Architecture," by John C. Wait; "The Law of Contracts," by John C. Wait; "Engineering Contracts and Specifications," by J. B. Johnson; "Specifications and Contracts," by J. A. L. Waddell and John C. Wait; "Law and Business of Engineering and Contracting," by Charles E. Fowler; "Contracts in Engineering," by James I. Tucker.

Prof. E. H. Freeman presided at the meeting and opened the discussion. He emphasized the larger work of the engineer in addition to mere technical training, and also spoke of the need of versatility in the engineer. Several others took part in the discussion.

Financing Electric Utilities.

Mr. R. J. Graf, secretary of H. M. Byllesby & Company, was the speaker at the meeting of the Electric Club of Chicago on May 10. His subject was "Financing Public Utilities," but he devoted his remarks principally to electric-service companies. He estimated the total capitalization of the central-station companies of the country at $1,500,000,000. Perhaps 75 per cent or 80 per cent of this is represented by actual book value. The securities of these companies are owned in every State of the Union and in almost every country of the globe. The speaker remarked that in some of the companies with which he is connected as high as 40 per cent of the dividend checks are made out in foreign exchange. The debt which the electrical industry of this country owes to foreign investors is large, although perhaps not generally realized.

Few of the issues of securities of electric-service companies are listed on the great stock exchanges of the country. Of late years, however, the market for such investments has been broadened greatly. Electric-service securities of the right sort are now sought by banks and brokers, who stand willing to purchase almost any amount if the stocks, bonds or notes are backed by the right kind of a financial statement and by the right kind of management. The consolidation of small properties into large operating syndicates has been of great benefit in giving the securities of the small companies a wide market. This consolidation also gives the smaller companies the benefit of highly scientific management.

Possible competition in public-utility service has been a drawback in the sale of securities, but with the growth of intelligent public sentiment this possibility is constantly decreasing. The prospective investor in electric-service securities is primarily interested in the earning capacity of the property. Within the last few years investors have evinced a remarkable interest in securities of this class, owing to their discovery of the excellent earning capacity which properly managed utility companies possess. Mr. Graf cited the year 1907, the so-called panic year, when most electric-utility companies showed an increase in net earnings at the same time that many railroad and industrial companies were showing a decrease in earnings. This fact attracted the attention of investors. The speaker also commented on the high character of the men engaged in the central-station industry, and concluded by saying that the future of this industry seems to promise continued success.

Mr. Harold Almert in opening the discussion said that many bankers agree that public-utility securities form the best class of investments on the market to-day, all things considered. Speaking of the attitude of the public toward utility companies, he remarked that one State has recently enacted a law allowing public-service companies to issue bonds equal to the full value of their tangible property, and also an equal amount of stock, the latter having a speculative value to which the promoters are entitled as a reward for their enterprise. The courts are careful and conservative in reviewing the decisions of state commissions.

Mr. Albert Scheible asked if a better feeling toward the utility is not secured where the securities are owned locally. Mr. Graf answered that at first the central-station companies were almost always financed locally. Now, however, the money is secured often through bond houses that distribute the securities to their own clients and customers and to the general investing public. Mr. Almert told of the case of a Toronto company in which 65 per cent of the stock is held locally by about 4500 owners, the average amount of each holding being perhaps $5,500. He pointed out that the current interest rates in the Southwest, for example, are very high, and it is a better economic proposition to sell the bonds of utility companies operating in that region in older communities where money is seeking investment.

Mr. J. R. Cravath mentioned the rapid growth of the electric-service industry and the bearing of that fact on the finding of money for constantly needed extensions. In many cases in former years it has been the practice to finance extensions out of earnings rather than to use the money to pay dividends. This practice has affected the sale of electrical securities unfavorably and is being done away with.

Uniformity in Telephone Rates.

As a result of the first telephone case considered by the Interstate Commerce Commission it has been decided that, "as between subscribers to a telephone service who are similarly situated, nothing but a difference in the service rendered or facilities furnished can justify a difference in the charges exacted."

The decision, prepared by Commissioner Harlan, was in the case of Mr. William D. Shoemaker, of Drummond, Md., against the Chesapeake & Potomac Telephone Company, the first telephone case considered by the commission since Congress placed

telephone companies as common carriers under the commission's jurisdiction. Mr. Shoemaker declined to sign the residence telephone contract presented because the charge demanded—the regular Washington rates—was materially higher than paid for the same service by twenty-seven neighbors in Drummond, old subscribers, who had contracted with the company when it operated the now abandoned exchange at Drummond. The complainant maintained that the rate was unlawful and discriminatory, but did not aver unreasonableness. The commission upheld his attitude as "entirely sound." It held:

"The contracts between old subscribers and the defendant, even though valid when made, cannot, after Congress has undertaken to regulate the rates and practices of telephone companies, be accepted as now justifying different charges as between different subscribers similarly situated, such undue discrimination being forbidden by the act."

Curiously, the ordered discontinuance of this discrimination will increase the company's revenues, as it necessitates increasing the rates of the twenty-seven old subscribers to conform to current rates.

Toledo Rates for Electric Service.

The Toledo (Ohio) Railways & Light Company has offered two plans of service charges to consumers since the City Council passed the ordinance fixing the price at 8 cents per kw-hour, with a discount of 1 cent for payment within ten days. In the first the company offers to furnish energy to all who will use as much as 20 kw-hours per month at 7 cents per kw-hour. The average home, the announcement states, uses 23 kw-hours a month and, under the new offer, there would be a saving of 23 cents a month over the old rate. It is argued that in order to serve the public at so low a rate each home must bear its proportionate share of the expense of installation and cost of production. For this reason a minimum amount of energy for which each must pay is fixed in the contract.

The other plan is to fix a flat rate of 30 cents a month for not more than three rooms and 10 cents a month for each additional room, after which a charge of 7 cents per kw-hour would be made for the first 10 kw-hours and 5 cents per kw-hour for the remainder of the energy furnished. This latter plan is for those who use energy for both lamps and motors for household purposes. In that case there would be no minimum charge of 50 cents per month and the householder would pay only the 10 cents a room in case he closed his home for a time in the summer when the family is absent. City Solicitor Schreiber claims that these rates do not conform to those in the ordinance and that, if the company insists, it will mean a fight. He says the city will not allow the proposed contracts to be carried into effect.

New Rate Schedule in New York.

The New York Edison Company and the United Electric Light & Power Company have promulgated a new schedule of rates which becomes effective July 1. Like the rate schedule now in effect, the system is shorn of all technicalities and is clean-cut, the consumer paying a straight rate regardless of maximum demand, or when or how the energy is used. Such discounts as are available are based on the quantity of electricity consumed. The general rate available to all consumers is as follows:

For the first	250 kw-hrs of monthly consumption	.....	10c per kw-hr
Next	250 " " " "	.....	9c " "
"	250 " " " "	.....	8c " "
"	250 " " " "	.....	7c " "
"	500 " " " "	.....	6c " "
Excess over	1,500 " " " "	for the excess	5c " "

These rates include carbon electrodes for and trimming of arc lamps, the supply and renewal of all standard incandescent lamps, or an equivalent allowance in the price of tungsten and tantalum lamps. Where advantageous to the consumer energy for motors may be included under the general rate. Customers making a yearly contract who agree to an average monthly use of not less than 1500 kw-hours, including energy used for motors if desired, may renew their own incandescent lamps, supply electrodes for and trim their arc lamps and otherwise care for their installations. For so doing they will receive a special discount of ½ cent a kw-hour.

The schedule of rates for energy consumed by motors is as follows:

For the first	200 kw-hrs of monthly consumption	.....	9.5c per kw-hr
Next	200 " " " "	.....	8c " "
"	2,500 " " " "	.....	6c " "
Excess over	2,900 " " " "	for the excess	5c " "

What is known as the "wholesale rate," which applies to those consumers requiring over 100,000 kw-hours per annum and is covered by a guarantee to use not less than that amount, is as given below:

First	100,000 kw-hours yearly consumption	5c per kw-hour
Next	100,000 " " " "	4c " "
Over	200,000 kw-hours excess yearly, at	3c " "
500,000 kw-hours yearly consumption, not to exceed		$17,500
625,000	" " " " "	20,000
833,333	" " " " "	25,000

The only concessions made from the schedules as given above apply to automobiles, storage batteries and electric refrigeration. In order to encourage the use of electric automobiles and of electric refrigeration the following favorable rates are held out by the company:

	Per Kw-hour.
For the first 2,500 kw-hours of monthly consumption	5c
Next 2,500 kw-hours of monthly consumption	4c.
Excess over 5,000 kw-hours of monthly consumption, for the excess ..	3c.

The schedule is dependent upon a minimum monthly bill of $25 and includes the agreement that where the amount of energy used does not exceed 50,000 kw-hours monthly the cost shall not exceed $1,500.

Massachusetts Legislative News.

On account of a division of opinion of the committee on street railways a new bill has been prepared for submission to the Legislature in connection with the proposed consolidation of the systems and financial organizations of the Boston Elevated Railway Company and the West End Street Railway Company. The new bill proposes the drawing of a fifty-year lease of the West End system by the Boston Elevated at a rate of 7.5 per cent dividends in place of the existing guarantee of 8 per cent by the Elevated. The protective committee of the West End stockholders is understood to be opposed to the bill and contends that an investigation of the Boston Elevated finances should be held before any legislative enactment occurs. A bill providing for such an investigation received an adverse committee report early in the week, but it is probable that any necessary inquiries can be made under a bill sponsored by the Boston Chamber of Commerce, which provides for the appointment of a commission to investigate the transportation facilities of the metropolitan district. There is little doubt that a way will be found to preserve the operating unity of the Boston transportation system before the lease of the West End to the Elevated company expires, since the duplication of plant and service facilities which would result from a re-establishment of the old conditions of separate administration and operation is everywhere conceded to be impossible economically. A hearing was held on May 8 upon the bill recommended by Governor Foss for the abolition of the Railroad, Gas and Electric Light, Boston Transit, and Massachusetts Highway commissions and the substitution of a public-utilities board for the entire group of services. No evidence of public interest in the propositon was displayed, and there is little doubt that the bill will be killed at the present session and the policy of the State continued with respect to the subdivision of its commission activities. It has been clearly shown that most of the commissions whose work touches that of public-service corporations are so fully occupied that their abolition in favor of a single board would work serious injury to the regulating policy of the State and result in

unsatisfactory relations between the companies and the representatives of the commonwealth.

The committee on mercantile affairs has recommended referring to the next Legislature so much of the special report of the Gas and Electric Light Commission upon electrical transmission as related, under Chapter 55 of the Resolves of 1910, to the public ways, waters and private lands, and to the placing of wires under ground in certain cities and towns. The commission reported upon these questions last winter, advising that for the present it appears unwise to pass laws granting the right of eminent domain to transmission companies.

The House has passed to be engrossed the bill (House 978) to exempt from the inheritance tax any shares in any railroad, street-railway or telephone company incorporated in the State if such property pays an inheritance tax in another state or country, and if such state or country grants a similar exemption in favor of citizens of Massachusetts.

Ohio Legislative News.

The Winters public-utilities bill, which was passed by the Ohio Senate by a vote of twenty-two to eight, having been sent back to the House for concurrence in the amendments, was taken up by that body on Thursday, May 11. After an acrimonious debate lasting the greater part of the day, a motion to concur was defeated by a vote of eighty-four to seventeen, and a conference committee was demanded. Speaker Vining named Mr. Winters, of Erie, author of the bill in the House; Mr. Kilpatrick, of Trumbull, and Mr. Langdon, of Warren. For the Senate Lientenant-Governor Nichols appointed Mr. Stockwell, of Cuyahoga; Mr. McGuire, of Tuscarawas, and Mr. Bader, of Hamilton. Senator McGuire had introduced a similar bill in the Senate.

Some uncertainty is felt as to the possibility of securing a satisfactory bill at the hands of this committee. Some of the members are radically opposed to the measure as it passed the Senate and will insist upon the amendments which the House added to the original bill, while others will argue that this is the best measure as it stands that can be secured under the circumstances and that it is much better than none. It is possible that a majority and minority report will be made, and this would make it impossible to secure the passage of either bill at this session.

Maryland Commission News.

An application from the Consolidated Gas, Electric Light & Power Company and allied concerns for authority to issue over $900,000 of new 4.5 per cent bonds was filed with the Maryland Public Service Commission last week. The application asks that permission be given for the issuance of $844,000 4.5 per cent general-mortgage bonds of the Consolidated Gas, Electric Light & Power Company and $60,000 4.5 per cent general-mortgage bonds of the United Electric Light & Power Company. The two issues were authorized at the meeting of the board of directors of the company held on March 15 last. The issues will be used for general construction and improvement purposes. Of the total issue of the Consolidated company $262,000 is to be used for the refunding of obligations. In the application is the statement that the Consolidated has a floating debt of $1,172,000 in short-term notes, and it will be to wipe out a portion of this indebtedness that the $262,000 will be used. The remaining $582,000 will be used for improvements. Of the $60,000 issue asked for the United company the full sum will be devoted to the paying up of obligations. The hearing of the application has been set by the commission for May 23.

A new telephone line from upper Maryland to the town of T. B., Prince George County, in southern Maryland, may be built in the near future as a result of the intervention of the Public Service Commission. The commission several weeks ago received a complaint from Mr. I. S. Brooks, a resident of T. B., regarding the lack of proper telephone service. The commission took the matter up with the Chesapeake & Potomac Telephone Company. Last week a letter was received from Mr. F. H. Bethell, of New York, vice-president of the company, asking that the commission withhold any action until a full report may be secured. Mr. Bethell said that the territory in which T. B. is situated is covered by the Southern Maryland Telephone Company, which has a traffic agreement with the Chesapeake & Potomac company. Mr. Bethell added that he did not believe that the Southern Maryland company would have any objections to the Chesapeake & Potomac building a line from Upper Marlboro to T. B., but that the latter company's consent would have to be secured before definite action could be taken.

New York Commission News.

The New York Public Service Commission, Second District, has received a complaint from the Board of Trade of the village of Adams, Jefferson County, directed against the Black River Telephone Company as to the rates charged for telephone service in that village. It is alleged that the rates now charged are unjust, unreasonable, discriminatory and unfair, and were made in violation of law and of the franchise granted by the village. The company was given a franchise upon the express stipulation that the charges for service in the village and vicinity should not exceed $15 per year for business places and $9 for residences, with a schedule of rates to outlying places.

On March 11, 1911, the rates were increased to $30 per year for business places, $24 per year for two-party line, $18 per year for multi-party line; for residences the charge was made $21 for direct line, $18 for two-party line and $15 for four-party line. The commission is asked to make an order directing that the company be required to reduce its rates to those provided in the franchise in June, 1901. The complaint has been served upon the company and an answer required within twenty days.

AMERICAN ELECTRICAL ENGINEERS—XXXIII.

Nicholas Stahl.

Nicholas Stahl was born at New Castle, Del., July 2, 1876. He received his early education at Muncy, Pa., and subsequently, after preparation at the School of the Lackawanna, Scranton, Pa., entered Princeton University in 1893, winning an entrance examination prize for the excellence of his papers. Four years later he was graduated second in his class with the degree of A.B. His interest was first directed to electrical affairs in 1887 because of severe burns and shock received from careless experimenting with the 500-volt trolley circuit of the Suburban Electric Company, of Scranton.

During his college course Mr. Stahl was actively interested in athletics and a club man. While at Princeton he was awarded "high honors" in mathematics and physics, won the Physical Fellowship and was admitted to membership in the Phi Beta Kappa fraternity. He remained at Princeton during 1897-8 as Fellow in Physics, making a specialty of electricity and particularly of Hertzian waves. Among his experiments in this branch was the establishment of well-defined standing waves 30 ft. long, even through stone walls, using cylindrical parabolloid reflectors of zinc, the nodal points and ventral segments being determined by varying the jumping distance of the spark. This was before Righi, the instructor of Marconi, had developed his short-wave oscillator, and represented a step toward the long waves necessary to long-distance wireless telegraphy. In 1898 he received from Princeton the degree of A.M., and shortly thereafter became the head of the science department and master of the Hamill House in the Lawrenceville School, Lawrenceville, N. J., well known as a preparatory school for Princeton and other colleges. While

here he made a study of Röntgen rays and radiography, with especial reference to their surgical application in the location of embedded foreign bodies and the prevention of maladjusted fractures, establishing the superiority of a Wehnelt form of coil interrupter for this kind of work. During this latter period he followed courses of some months at Harvard, and in 1905 took a short course in mechanics and the electromagnetic theory of light at the Technical High School of Charlottenburg, Germany. In 1906-7 he studied electrical engineering at Princeton, under Dr. C. F. Brackett, giving particular attention to oscillographic work, and received in the latter year the post-graduate degree of E.E. from that university.

Since 1907 Mr. Stahl has been with the Westinghouse Electric & Manufacturing Company, of East Pittsburgh, Pa., in various capacities. Wishing to familiarize himself with manufacturing methods, he first entered the shops as an engineering apprentice, and in particular gave several months to construction and testing work on the single-phase locomotives for the New York, New Haven & Hartford Railroad and Spokane & Inland Railroads. After some months in the testing department he entered the railway department as a corresponding engineer. During this time he also acted as a part-time instructor in the Carnegie Technical Schools of Pittsburgh. At present he is commercial engineer in the railway and lighting department, as head of the general contract division, which has charge of the commercial and engineering oversight of many of the company's large negotiations and contracts. Lately he has refused a call to the chair of electrical engineering of one of the prominent Eastern colleges, preferring to continue in more active work.

Nicholas Stahl.

Mr. Stahl has contributed a number of articles to the technical press, among which the following have appeared in these columns: "Distribution and Breadth Coefficients of Alternators" (Nov. 9, 1907); "Three-Phase Power-Factors by Single-Phase Wattmeter" (Aug. 28, 1908); "Experimental Determination of the Hysteretic Exponent" (Nov. 21, 1908), of which a translation appeared in *Elektrotechnik und Maschinenbau* (Vienna) Jan. 24, 1909: "Transformer Currents in Weakened Deltas" (May 26, 1910), and "A Network Problem" (Sept. 8, 1910).

Mr. Stahl is a member of the Princeton Alumni Association of Western Pennsylvania and an associate member of the American Institute of Electrical Engineers.

CURRENT NEWS AND NOTES.

Boston Electrical Show.—The 1912 Boston Electrical Show will be held in the Mechanics' Building from Sept. 28 to Oct. 26, 1912. The manager of the show is Mr. Herbert W. Moses, 39 Boylston Street, Boston.

The International Association of Municipal Electricians.—This association will hold its next convention in St. Paul, Minn., on Sept. 12-15, the headquarters being at the Ryan Hotel. The president of the association is Mr. H. C. Bundy and the secretary Mr. Clarence R. George, Houston, Tex.

Revision of Electric-Service Rates in Chicago.—On May 8 at a meeting of the Chicago City Council Alderman Pringle secured the passage of an order directing the committee on gas, oil and electric light to make a study of the rates for electric lighting and motor service as supplied by central-station companies of Chicago. The revision of these rates will come up in July, 1912, and the committee desires to make a careful study of the subject in advance. The Commonwealth Edison Company's primary rate for energy for lighting is 11 cents a kw-hour, having been recently reduced from 12 cents. The secondary rate is 6 cents.

Proposed Chicago Subway.—At a meeting of the Chicago City Council on May 8 Alderman Snow introduced a resolution, which was adopted, calling on the corporation counsel to report what legislation is necessary to enable the city of Chicago to construct a system of subways for the transportation of passengers and merchandise. Other information about the legal and financial aspects of the proposal is also requested in the resolution. The resolution is particularly interesting because it refers to the transportation of "passengers and merchandise," whereas it has been assumed heretofore that the proposed subway was to be entirely for passenger traffic.

Pittsfield A. I. E. E. Dinner.—Elaborate arrangements were made for the fourth annual dinner of the Pittsfield Section of the American Institute of Electrical Engineers on May 4, and they were carried out with a high degree of success. The dinner commemorated the twenty-fifth anniversary of the first commercial application in this country of the transformer and the alternating-current generator. The guest of honor was Mr. William Stanley, who designed the first alternator built in America. A miniature model of the famous Stanley transformer was presented to each of the guests. The toastmaster was President D. C. Jackson. In addition to Mr. Stanley the other speakers included Dr. C. P. Steinmetz, Prof. Elihu Thomson and Messrs. C. F. Scott, T. C. Martin, E. W. Rice, P. A. Russell, F. J. Sprague, F. Darlington and W. S. Moody.

New York Section I. E. S.—At the meeting of the New York Section of the Illuminating Engineering Society held on May 11 Dr. R. S. Woodworth, professor of psychology at Columbia University, delivered an instructive address on the "Psychology of Light." The speaker outlined the relation between purity of color, the admixture of color with black and the intensity of light stimulus, and showed in what respect the physicist differs from the psychologist in explaining the phenomenon of light. His demonstrations were based on the well-known color circle, according to which the colors of the spectrum form an almost complete circle, the final arc being filled in with impure mixed colors. Such a circle seems logical to the psychologist, but is contrary to the wave-frequency theory of the physicist. The nominating committee proposed the following men for election to the offices indicated at the June meeting of the section: Mr. Bassett Jones, Jr., chairman; Mr. A. J. Marshall, secretary; Dr. H. H. Seabrook and Mr. H. T. Owens, managers.

Increase in Motor Load.—So rapid has been the increase in the motor load on the system of the Muskogee (Okla.) Gas & Electric Company that values compiled at one time give almost no indication of the values a few months later. For example, the motor load in 1910 was 436 hp, as reported in our issue for May 4; at the present time the load has reached about 1700 hp, the increase being nearly 300 per cent.

Lignite for Fuel.—In an address before the American Philosophical Society, Philadelphia, on May 5 Mr. Joseph A. Holms, director of the United States Bureau of Mines, showed that the deposits of lignite in the United States cover 116,700 sq. miles, 53,000 sq. miles of which are in Texas and 31,000 sq. miles in North Dakota. Investigations indicate that lignite can be made into briquettes on a commercial scale for use as fuel, especially for domestic purposes.

Cost of Arc Lighting.—At a meeting of the Pittsburgh Section of the American Institute of Electrical Engineers held on May 9 Mr. W. Edgar Reed, consulting engineer, read a paper on the cost of electrical energy as applied to small and moderate-size stations, with particular reference to arc lighting. The author showed that values specified for such service are usually misleading by reason of the failure to take various items into account. The discussion was participated in by Messrs. R. D. Thomas, C. E. Stephens and H. N. Muller. An abstract of the paper will appear in a later issue.

American Association for the Conservation of Vision.—On May 13 the American Association for the Conservation of Vision was incorporated to study conditions and causes which result in blindness and impaired vision, the relation of eye strain to physical and mental health and to human efficiency, and to devise means to prevent blindness. The incorporators are Messrs. Samuel Ely Eliot, T. Commerford Martin and M. C. Whitaker. The president of the association is Dr. F. Park Lewis, Buffalo, N. Y. The secretary is Mrs. Ida B. Hiltz. The headquarters are in the Engineering Societies Building, New York.

Energy Transmission from the United States to Mexico.—A recent dispatch from Douglas, in the southeastern corner of Arizona, practically on the international line dividing that territory from Mexico, says that the transmission line between Douglas and the El Tigre mines in the State of Sonora, Mexico, is now complete except for a short distance across the Yaqui River. This transmission line will supply electrical energy to a number of mines in a large area of northern Mexico, the electricity being generated at the Copper Queen smelter in Douglas. The availability of this energy will enable many mining operators to work properties hitherto lying unused owing to the lack of fuel and water.

Alleged Electrical "Graft."—According to newspaper accounts the Sanitary District of Chicago, a municipal corporation, has been cheated by the distribution of electrical energy in Lockport, Ill., to persons who paid little or nothing for it. The District generates electricity from the water-power of the Chicago Drainage Canal in a station at Lockport, and it is alleged that a condition of wire tapping, meter tampering and juggling of accounts has been found to exist in the case of many customers or supposed customers in that city, which is 30 miles from the main office in Chicago. In general, it appears, things were run loosely in relation to the local distribution in Lockport and several employees were discharged.

St. Louis Section, N. E. L. A.—At the recent meeting of the St. Louis Union Electric Light & Power Company Section of the National Electric Light Association Prof. A. S. Langsdorf, dean of the engineering faculty of Washington University, St. Louis, delivered an illustrated lecture on the oscillograph. He discussed the history of the methods used to study the internal action of alternating-current machinery and referred to various instances where the study of the emf and current curves as given by the oscillograph have assisted in the detection of the causes of trouble. Professor Langsdorf also exhibited an oscillograph, which he operated, showing curves of various kinds on the screen. The audience was also entertained by moving pictures of the principal waterfalls of the United States.

New York Electrical Society Meeting.—The subject for discussion at a meeting of the New York Electrical Society to be held in the Engineering Societies Building on May 18 will be the production and application of the Edison storage battery. The chief speaker of the evening will be Mr. Frank L. Dyer, for many years an associate of Mr. Edison in charge of his patent and business interests. The lecture by Mr. Dyer will be illustrated by numerous lantern slides, and a novelty will be introduced in the form of motion pictures illustrating the advantages of electricity as a vehicle motive power as compared with the horse and gasoline. Among the applications of the battery that will be illustrated are pleasure vehicles, trucks, delivery wagons, ambulances, dock trucks, omnibuses, street cars, inspection cars and submarine boats.

Illinois Waterway Project.—Governor Deneen's waterway bill passed the Senate of the Legislature of Illinois on May 9. At that time, however, it was predicted that the measure would fail to pass the lower branch of the Legislature. The Governor is very much interested in the passage of this bill, and sent a special message to the Legislature in relation to it recently. It is proposed to provide a deep waterway or canal from the present hydroelectric plant of the Sanitary District on the Desplaines River at Lockport, Ill., to Utica, Ill., which is the present head of navigation on the Illinois River. A bond issue of $20,000,000 to effect this improvement has been voted on favorably by the citizens of the State, but the Legislature has declined so far to enact the necessary law. An important feature of the project is the utilization of the water-power which the proposed waterway would provide. The Governor declares that it is only by the acquirement of these water-power sites by the State and the preservation of the public rights in the water-powers along the Desplaines and Illinois Rivers that the State can defray the cost of waterway construction and so retire the $20,000,000 of bonds which it is proposed to issue without expense to the State.

Meeting of the New York Companies' Section of the N. E. L. A.—At a meeting of the New York Companies' Section of the N. E. L. A. at the Engineering Societies Building, New York, May 15, the secretary announced that the membership at that time had exceeded 1300, making the New York Companies' Section the banner section in the association and bringing the total membership of the N. E. L. A. above 8200. Chairman Arthur Williams, who is also chairman of the entertainment committee of the N. E. L. A., outlined the entertainment features for the coming convention, accentuating the fact that the local companies would, of necessity, have to act as hosts for the delegates from all over the country. The speaker of the evening was Mr. Nikola Tesla, who delivered an illustrated lecture on the experiments with high-frequency currents which he made in New York and Colorado Springs and his work on wireless transmission of energy on Long Island. He also illustrated and described for the first time in public his more recent inventions in blowers, turbine pumps and steam turbines. In order to demonstrate that his theories on the latter class of apparatus were not visionary, Mr. Tesla showed actual photographs of pumps, blowers and turbines built, and also had a small model on view in the auditorium which he set in operation during the course of his lecture. The audience filled all of the lower floor of the auditorium, with an overflow in the galleries. Four papers which were listed for presentation at the meeting were held for presentation at the next meeting. A short vaudeville show was given after the lecture.

HYDROELECTRIC ENERGY FOR THE BEDFORD STONE INDUSTRY.

Water-Power Plant, with Steam-Turbine Auxiliary, Operating Quarries and Mills in the Famous Indiana Oölitic-Limestone District.

OF all the applications of electricity for industrial purposes there is perhaps none more interesting or less known than the use of motor drive in quarrying and milling the unsurpassed building stone of the Bedford oölitic district in Indiana. Isolated mill generating plants scattered over the region have already been in operation for several years, demonstrating the efficacy of electric drive, but the month of March marked the beginning of operation of a central power station which will make motor drive possible for every quarry and mill in the Bedford district.

This plant is a combination steam and water-power station developing an ultimate 5000 kw from a 17-ft. fall in the White River, 10 miles from Bedford, and is provided with a steam-turbine auxiliary for relay service during the month or two in the year when water conditions impair the output of the hydro-electric equipment.

Already in the Bedford district electricity is being used with marked success and economy for every step in the preparation of the stone for the market. Motor-driven "channelers" cut deep slots into the rock benches, while motor-driven derrick-hoists rend the severed blocks from their native beds and lift them to the stoneyard. Here motor-operated traveling cranes pile them away or place them aboard cars for delivery to the mills. In the latter a variety of operations are accomplished by electric drive, the blocks being sawed to size, planed, turned in lathes, or formed as desired, by huge motor-driven machine tools. Many of the great saws run day and night, so that the generating plant is assured a good load-factor from the mills, although the quarry demand is less steady during the 10-hour working day and is off altogether for the three winter months. There are fifteen quarries and thirty-five mills in the Bedford district, all of which are within a radius of 3 miles of the sub-station at Bedford.

Later, if the present plans of the Southern Indiana Power Company, which is making these developments, are carried out, another water-power station will be built below the present site, co-operating with the same steam auxiliary; and a transmission network will be extended throughout the oölitic limestone field to take in the stone district near Bloomington and Oölitic, Ind.

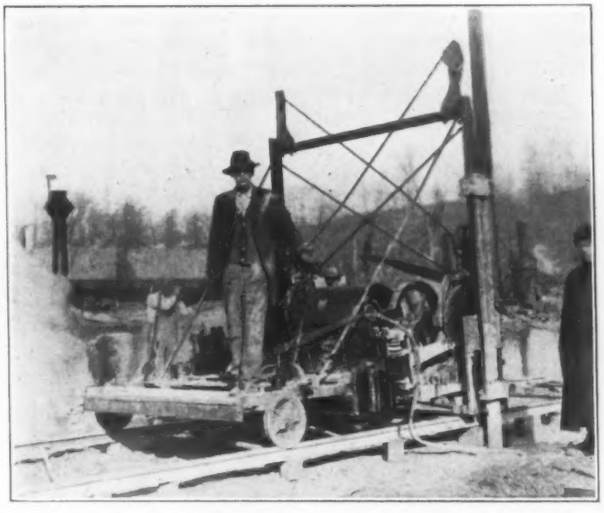


Fig. 2—Motor-Driven Channeler in Use at Bedford.

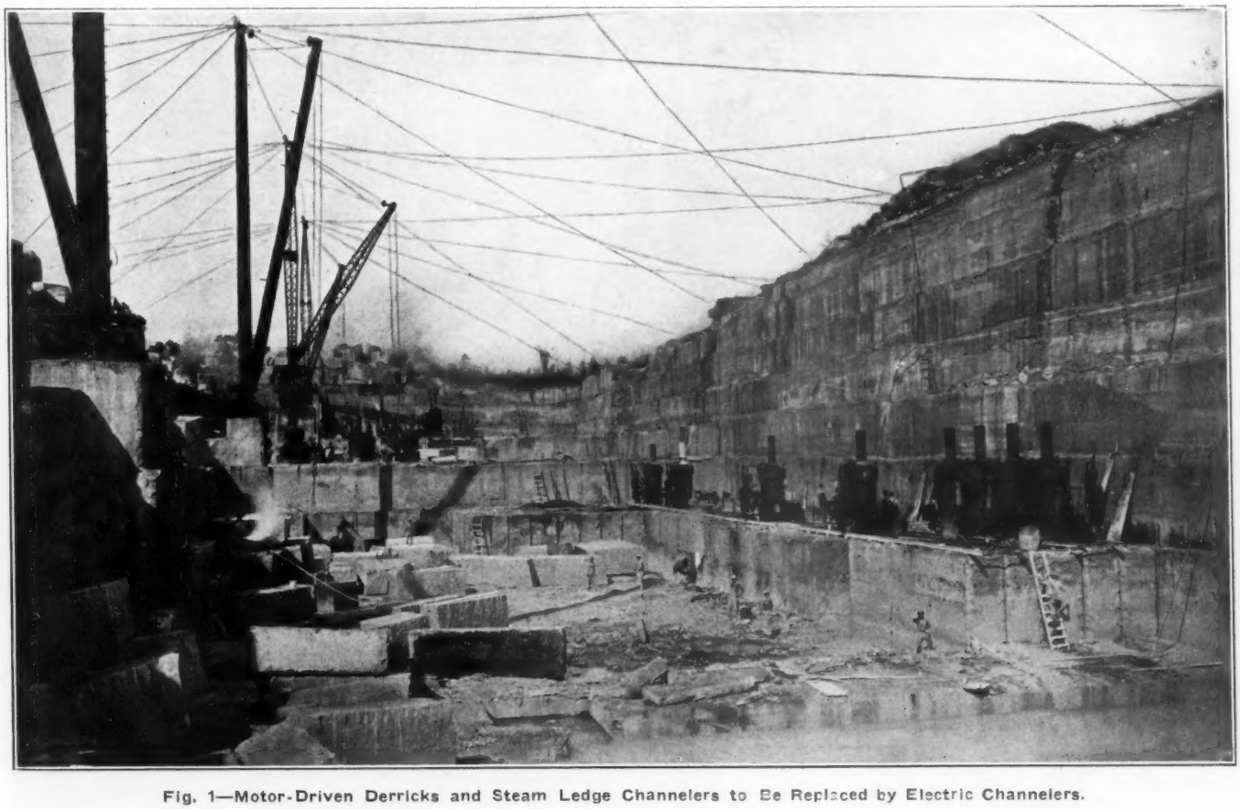


Fig. 1—Motor-Driven Derricks and Steam Ledge Channelers to Be Replaced by Electric Channelers.

POWER HOUSE AT WILLIAMS.

The generating station of the Southern Indiana Power Company is at Williams, on the east fork of White River, 10 miles west of Bedford. Here a 17-ft. head is available with an average stream flow of 2200 cu. ft. per second. By conserving this behind a suitable storage dam an ultimate total mean daily

output of 5000 kw in water-power during most of the weeks of the year will be assured.

On account of the absence of sufficient condensing water at Bedford, and for simplicity in the control and switching of the high-tension transmission line, the steam-power relay plant has

Fig. 3—Distribution System of the Southern Indiana Power Company.

been combined wth the water-power station at Williams. In order that service might be rendered the quarries and mills at the earliest possible moment, the steam plant was completed first, two 750-kw horizontal turbine-generator units being initially installed, to be followed by a 2500-kw unit. In the design of this steam relay plant attention was paid to constructing it with all possible simplicity, in view of the short periods during each year when it would be called upon for aiding the water-power equipment. Although the plant is therefore free from some refinements which might be expected in a station designed for continuous duty, no element is lacking to insure the reliability and efficiency of operation demanded for supplying energy to an important transmission and industrial-plant system.

During about 100 days in the year it is expected that low water conditions will require the operation of part or all of the steam plant to aid the waterwheels. For another ten days the spring floods will probably render the hydraulic plant inoperable owing to back water. During these periods steam will be held in the boilers ready to supply any deficiency in the output of the waterwheels.

The power house is a molded concrete structure, the future generator room measuring 175 ft. x 45 ft. over all. Of this length 125 ft. is given over to the water-power units and 50 ft. to the steam-turbine sets. Adjoining the turbine end of the main station is a 50-ft. x 120-ft. concrete building containing the boiler equipment.

STEAM-RELAY EQUIPMENT

The Bedford district is not far from the coal-mining region of Indiana, and coal laid down in the bunkers of the station at Williams costs only $1.30 per ton. Four 408-hp Stirling boilers with Roney stokers constitute the initial steam-generating equipment. These furnaces are provided with induced draft into a 3-ft. x 8-ft. stack, extending 14 ft. above the power-house roof, by two 50-hp engine-driven fans, either one of which is capable of operating all four boilers at full load. Together they can carry a boiler overload of 100 per cent. The blower-engine valves are controlled from pressure gages on the boiler steam lines, being so arranged that in case of drop in pressure due to steam demand the fans are automatically speeded up, thereby increasing the draft and hence the output of the boilers.

On the framework beneath the engine-driven fans is a 2000-hp Cochran open feed-water heater to which the exhausts from the auxiliary pumps and the drains from the main steam pipes are led. The boiler pumps are of the reciprocating type, and all pipe construction is extra heavy and equipped with non-return check valves. The future boiler-room will contain another set of four boiler units like those installed, arranged along the opposite side of the building. Until these extensions are made, and on account of the brief operating periods during which the plant is expected to be in service, no provision has yet been made for storing or handling coal for the stokers.

The turbine-room contains two 600-kw Allis-Chalmers Parsons-type steam turbines, directly connected to 750-kva Allis-Chalmers 2300-volt, 60-cycle, three-phase alternators, the excess generator equipment being provided to allow for reduced power-factor of the station load. A similar 2500-kva steam-turbine set is now being installed. The turbines are supplied with steam at 160 lb. per square inch, and exhaust into Tomlinson jet-type siphon condensers. These condensers are able to carry a 28-in. vacuum with the turbines fully loaded, or a 27-in. vacuum with one turbine 50 per cent overloaded. The wet and dry centrifugal pumps are driven by Kerr steam turbines at 1200 r.p.m. Condenser injection water will be taken through an inlet tunnel from the upper pond level, but for operation until the dam is completed a centrifugal pump has been installed to raise the water from the river to a bulkhead erected in the inlet.

In addition to one 50-kw and one 100-kw, 2300-volt motor-driven exciter set, which can be operated from the generator buses, there is provided a 55-kw high-speed, engine-driven exciter for starting up the steam plant.

The generator-room floor is raised about 25 ft. above the crest of the dam. The foundation and structure are thoroughly waterproofed up to this level as a protection against extreme high water in the river.

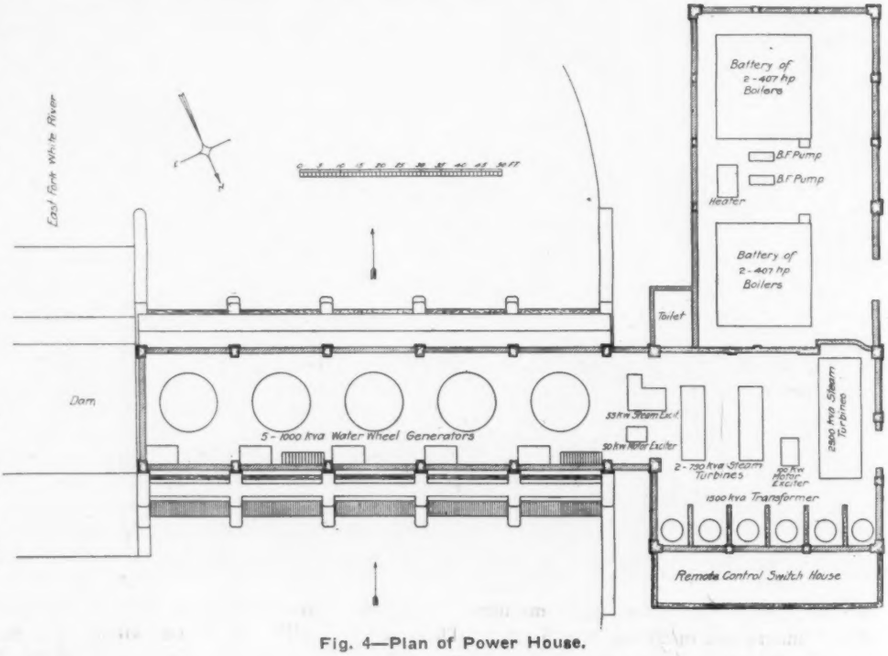


Fig. 4—Plan of Power House.

The condenser intake well is inclosed in the concrete foundations of the plant, and is held at a constant level by a float-controlled valve.

WATER-POWER PLANT.

The east fork of the White River at this point drains an area of 4500 sq. miles, and, as already noted, the flow of the

stream is about 2200 cu. ft. per second on an average day of the year. The dam under construction will create a storage pond of about 1000 acres in extent, having a storage capacity of 45,000,000 cu. ft. for each foot of depth. The demand on the generating station, due to the stone industry, will be largely a day motor load. It will accordingly be the practice, in operating the plant, to draw down the reservoir during the day by about 2 ft., allowing the normal stream flow to restore the level during the off-peak hours. The turbines are designed for this reduced head. In this way it will be possible to deliver an ultimate demand of 5000 kw in the hours of the working day.

The dam is of the Ambursen hollow reinforced-concrete type, 300 ft. in length and 17 ft. high. At its north end the power-house foundation forms an extension to the dam 125 ft. in length, making the entire structure 425 ft. in total length. Measured from the mattress of the dam to the roof of the power

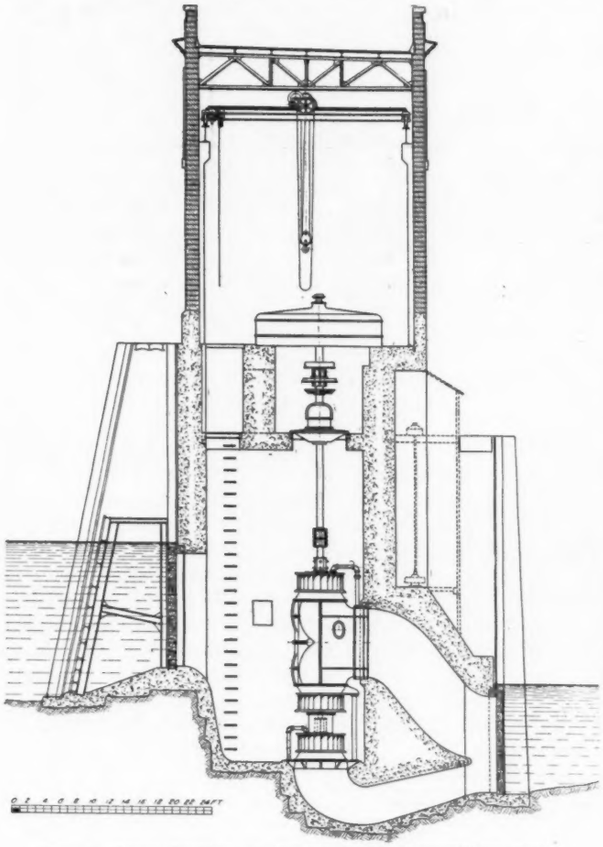


Fig. 5—Cross-Section of Turbine and Generating Room.

house the concrete work has an extreme height of 102 ft. In the excavation to make way for the dam and wheel pits, 10,000 cu. yd. of rock and 6000 cu. yd. of earth have been removed, and the completed dam and power-house structure will contain 7000 cu. yd. of concrete. Work was begun at the site in June, 1910; steam-turbine operation was begun in March, 1911; and the waterwheel units will be ready to begin work by July, 1911.

The hollow concrete dam is provided with a passageway extending through its interior from shore to shore. Reinforced-concrete buttresses carry the 45-deg. sloping upstream deck of the dam, which resists overturning by the weight of the water which it impounds.

A total of five 1000-kva vertical waterwheel units will be installed in the Williams plant. The initial pair of these will be Allis-Chalmers vertical-shaft machines, each with three 48-in. runners and operating at 128 r.p.m. These turbines will operate efficiently over a range in head from 17 ft. to 12 ft., although speeded at 128 r.p.m. for 16-ft. head operation. Two 1000-kw, vertical-shaft, duplex 72-in. runner units, which will follow the first installation, are arranged to operate at 82 r.p.m. under 15-ft. head. The governors for these machines will be of the Allis-Chalmers oil-operated type. In addition to the 100-kw and 50-kw, 2300-volt motor-driven exciters, as mentioned above, a 27.5-kw exciter unit is arranged on a countershaft so that it can be driven from any of the waterwheel units, in this way enabling the waterwheel alternators to be started up without recourse to the engine-driven exciter in the steam plant.

Water entering the forebay in front of the trash racks will be cleared of floating material by an extension boom. The head gates will be hand-operated. The discharge tubes from the waterwheel runners are arranged with overhead and under-shot curves, which has permitted the wheels to be depressed to the lowest possible level.

SWITCHBOARD, SWITCHING, ETC.

The controlling switchboard is mounted on an overhead gallery running along the north side of the generator room. On the same level is the 22,000-volt high-tension apparatus leading to the line exits and transmission line outside. Beneath the switchboard gallery are the step-up transformers in separate

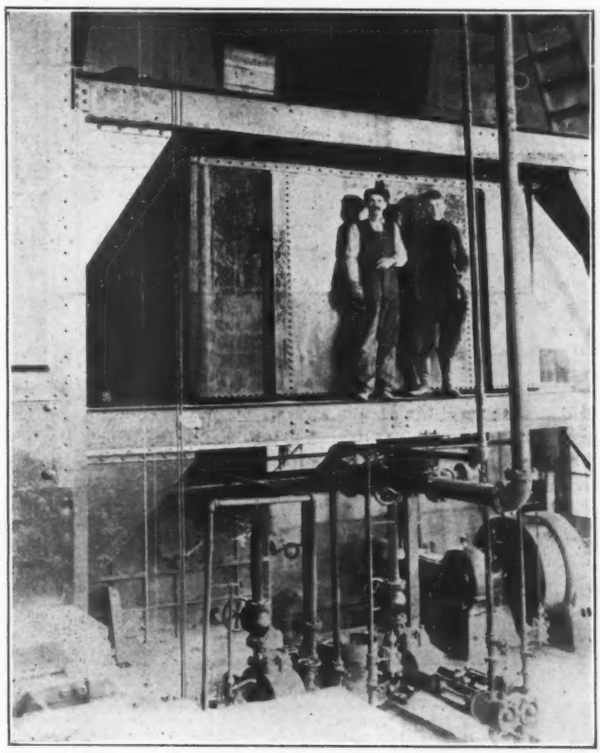


Fig. 6—Feed-Water Heater and Draft Fans in Boiler-Room.

concrete-barrier compartments, and behind them the 2300-volt switchroom, which is entirely remote-controlled.

The combination steam and water-power plant at Williams is arranged so that it can be operated, and any machine put into service, by one man. After starting up any waterwheel or steam-turbine unit from the floor of the station, the operator can ascend to the switchboard gallery and from there control the governor setting of any machine, synchronizing and paralleling it with the buses, without leaving his station. The black slate switchboard comprises in all eighteen panels, providing for the future number of steam-driven and waterwheel machines, besides the transformer panels, exciter panels, motor panels, synchroscope and voltmeter panels, etc. The Tirrill regulator with which the board is furnished can be applied to either half of the 2300-volt bus, which is sectionalized by an oil tie-switch. The field circuit rheostats are mounted at the ceiling, 15 ft. above the switchboard handles, from which they are manipulated through sprocket chains inclosed in piping.

As before noted, all the 2300-volt switches are remote-controlled by solenoids, and are mounted in the switchroom beneath the switchboard. In this room are also assembled the

various automatic starters and other apparatus needing expert attention. The 2300-volt and control-circuit leads are brought up through the concrete floor in iron conduit, which is extended to a height of about 2 ft. above the floor, thus protecting the inclosed wires and cables from accidental damage or scuffing. All live parts are insulated to withstand full potential, and no exposed charged metal appears anywhere on the switch and busbar structure, except the buses themselves, 8 ft. above the floor. Between the steam and waterwheel generator sections series transformers are inserted into the main buses, the secondaries of which operate watt-hour meters, showing respectively the total generated output of the steam and water-power plants. An alarm bell on the switchboard announces the operation of any circuit-breaker.

The transformer compartments, half inclosed, are of reinforced concrete, 12 in. thick. The present equipment comprises three 750-kw units, stepping from 2200 volts to 22,000 volts; later these transformers will be transferred to the Bedford substation, being replaced by three 1500-kw units. Extra compartments are provided for three additional 1500-kw units. The transformers are water-cooled by motor-driven circulating pumps, as the station floor is 25 ft. above the crest of the dam.

From the high-tension terminals of the transformers, through Locke ceiling bushings, the 22,000-volt conductors (all of which are of ¾-in. solid-copper section) are carried up through concrete troughs to the disconnecting switches leading to the oil switch. These high-tension bus troughs are 24 in. x 24 in. in section, and are separated by 4-in. walls of concrete. They are covered over with 2.5-in. concrete slabs, having eye-bolts cast in their tops to facilitate handling. The line circuits pass through disconnecting switches to the solenoid-operated line oil-switch, thence through disconnecting switches, series transformers and choke coils to the line entries. Here they are tapped by discharge paths leading to horn-gaps in series with aluminum-cell lightning arresters. A small aluminum cell, inserted in the ground discharge line, is bridged by a bell, which rings when the arresters discharge.

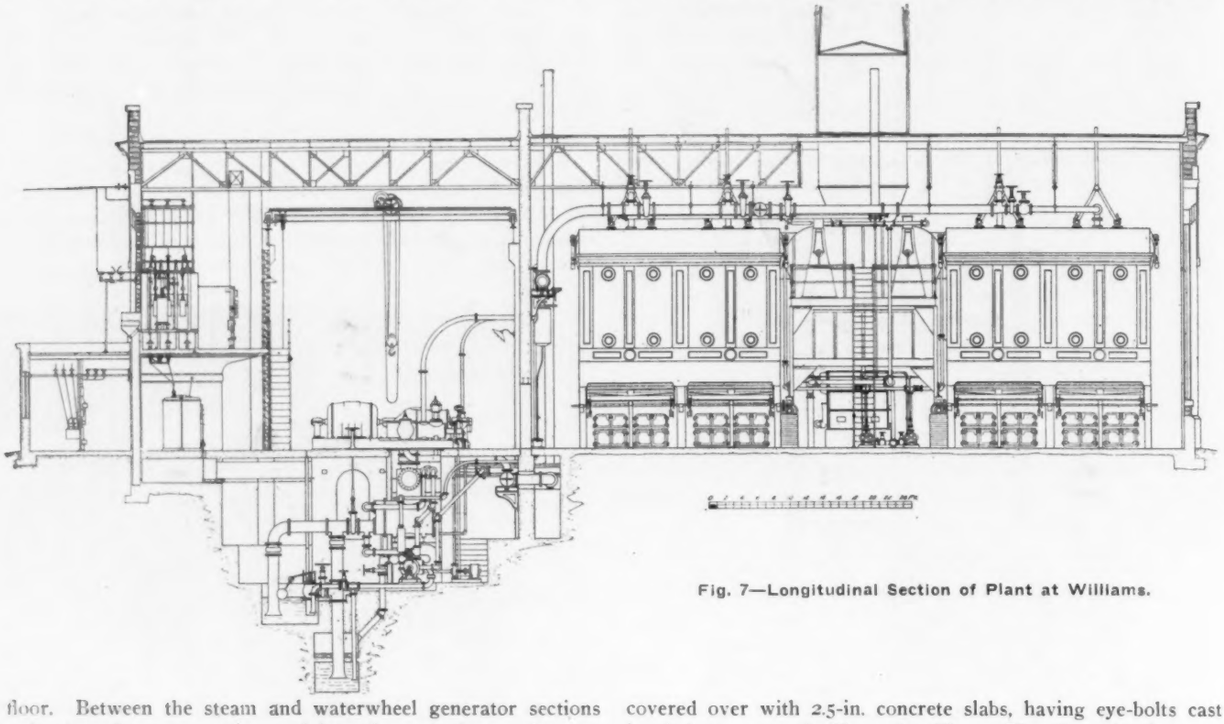


Fig. 7—Longitudinal Section of Plant at Williams.

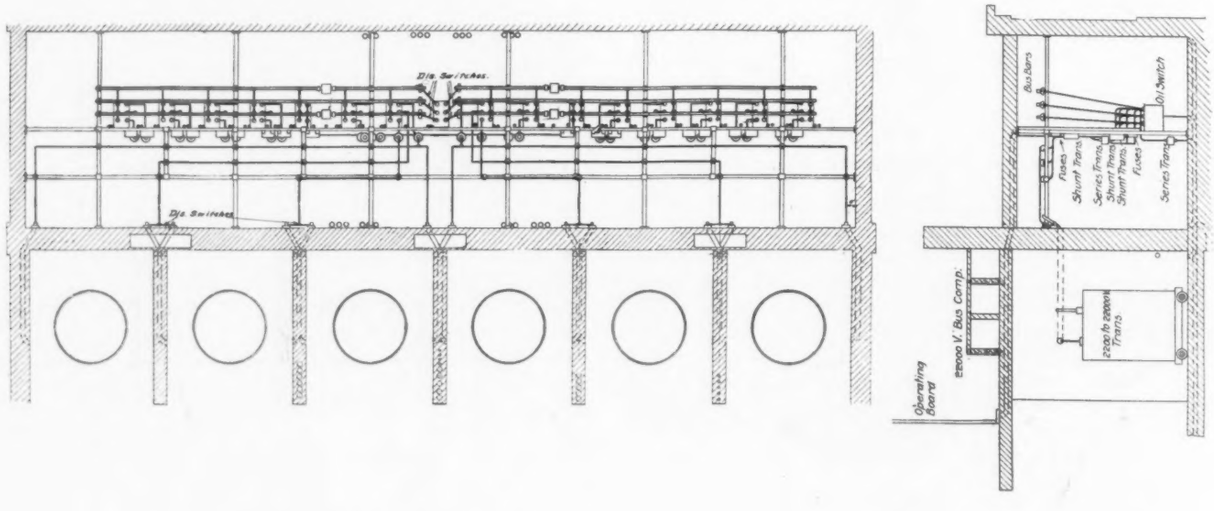


Fig. 8—Longitudinal and Transverse Sections of Switch House at Williams.

TRANSMISSION LINE.

The 22,000-volt transmission line, 9.6 miles in length, into Bedford is carried on 40-ft. steel towers, set at 300-ft. dis-

tances. Each tower weighs 1000 lb. and has a square base, 5 ft. on a side. Although 40 ft. in height, the legs are set 5 ft. into concrete footings buried in the earth, so that the towers themselves stand 35 ft. above the earth. The towers carry 10-ft. lower and 7-ft. upper cross-arms, supporting, on 33,000-volt insulators, two three-phase circuits of No. 3 hard-drawn copper wire. The wires are arranged at the apices of 36-in. triangles, one circuit being carried straight through, while the other is given two complete turns in the 9-mile distance, for purposes of transposition. The peaks of the poles are arranged to carry a 0.5-in. stranded-messenger ground wire for lightning protection. A telephone circuit between the power house and substation is mounted on the same towers, but is maintained as a private line by the Central Union Telephone Company, the Bell licensee in Indiana.

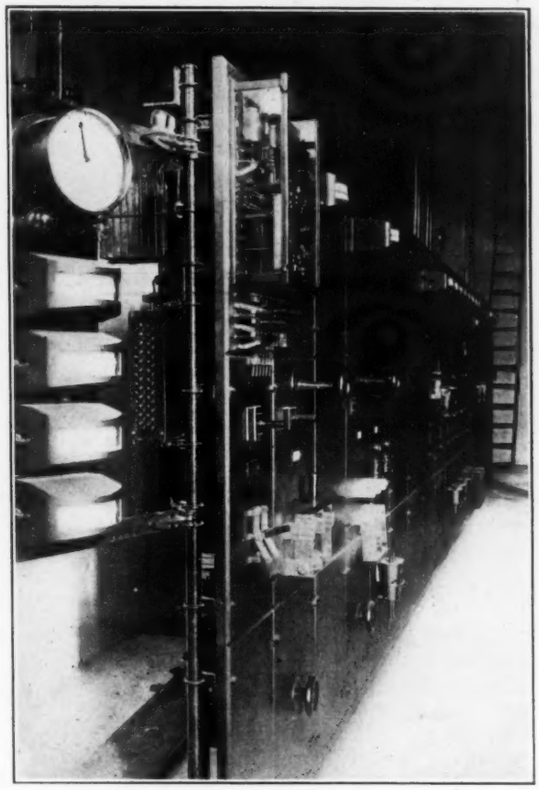


Fig. 9—Switchboard in Power House at Williams.

Three miles from Bedford the 22,000-volt transmission line is tapped through a special switch tower for supplying energy to operate the Gilberson quarry near by. The disconnecting switches are of the outdoor type and have been fitted with specially designed porcelain-inclosed expulsion-type fuses for this outdoor use. This quarry customer is now served through a bank of 250-kw transformers, stepping down from 22,000 volts to 220 volts. Later, it is the intention to remove this high-tension tap into the transmission line, making provision to supply the service over a 4000-volt feeder from the substation to be installed at Oölitic.

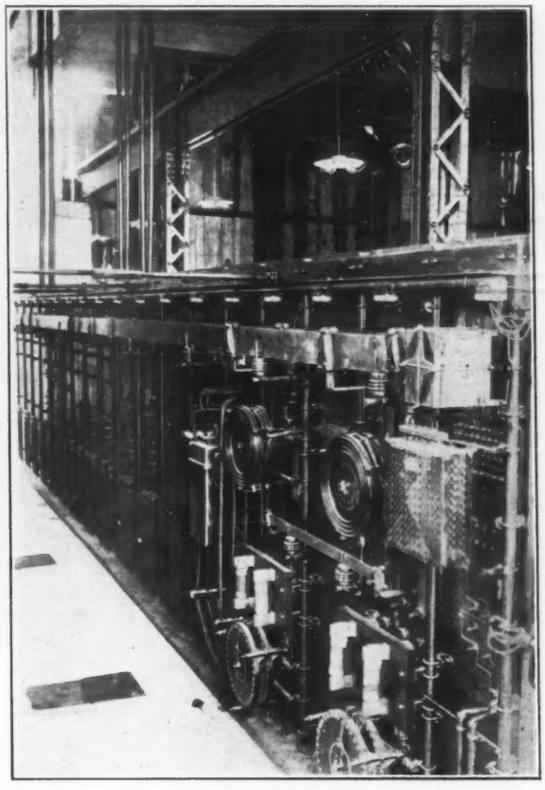


Fig. 11—Rear of Switchboard at Williams Power House.

BEDFORD SUBSTATION.

The substation, located on the northwestern edge of Bedford, is a steel-frame building, with walls of "hy-rib" center plastered with concrete. Entering the station through porcelain bushings set in 19-in. square soapstone slabs, the high-tension conductors, insulated against full voltage, are carried through the choke coils and disconnecting switches. Taps are taken off instrument transformers for operating voltmeters, showing the presence of high voltage on the lines, and also for feeding the pressure windings of reverse-power relays having instantaneous automatic trips. In conjunction with the inverse-time-element release of the circuit-breakers at the Williams power house, this arrangement immediately disconnects either circuit showing line trouble when operating in parallel with the other line. En-

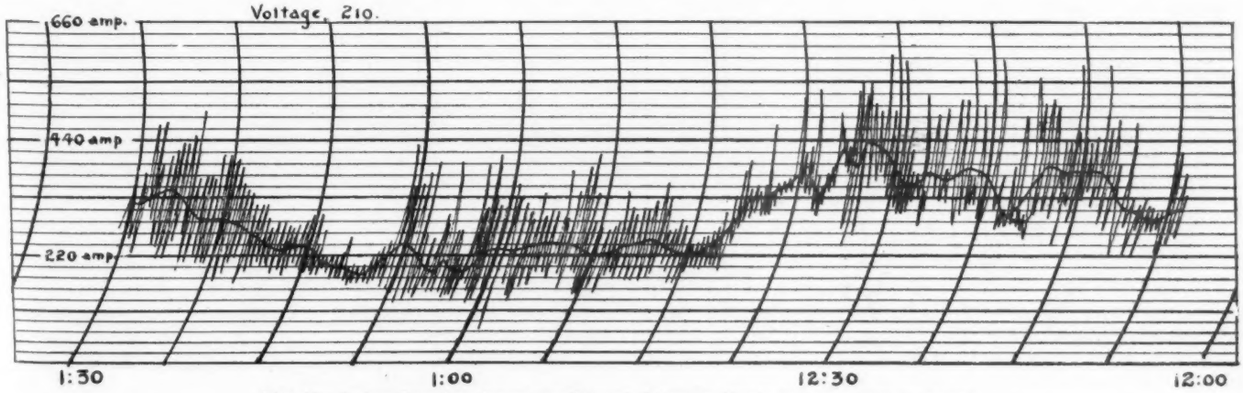


Fig. 10—Curve-Drawing Ammeter Record, Showing Typical Stone-Mill Demand.

ergy to operate the Bedford substation high-tension oil switches is assured by a 40-amp-hour, 45-cell storage battery, which can be charged by a 0.5-kw motor-generator set, run off the station-lighting circuit. From the high-tension oil switch the full-

Fig. 12—Remote-Control-Switch Room in Williams Power House.

insulated 22,000-volt lines are brought through series transformers and disconnecting switches, in concrete and transite barriers, to the inclosed-trough bus construction leading to the transformers below. Three 500-kw, 22,000-volt transformers are already installed, provision being made for the three 750-kw units to be brought from the Williams station. From each high-tension line wire, outside the station, aluminum-cell arresters are grounded to a common bus, which in turn is connected through a fourth cell, a transfer switch being provided for maintaining the film on the latter ground-cell plates. Static potential indicators hung on the high-tension buses show the presence of high-potential charge on the lines. The high-tension entries into the substation have been constructed with apparently the minimum of 22,000-volt conductor. As a safeguard to life, however, all high-tension wiring is insulated to withstand the full potential carried. The transformer windings are connected in delta on the 22,000-volt side, and in star on the 2200-volt side, making a secondary delta pressure of 3800 volts available between line conductors.

The switchboard is arranged with transformer panels for both groups of apparatus, and when completed will have fourteen feeder panels, each equipped with ammeters and oil switches with overload tripping device. In the center of the board will be a tie-switch panel for manipulating the high-tension oil switch which will link together the two sections of 22,000-volt busbars.

From the substation fourteen distribution feeders run to the various mill and quarry properties served. The neutral points of these circuits are well grounded at both the substation and customers' installation, so that in case of injury to one secondary transformer of a group the other two can be temporarily operated over the ground path provided.

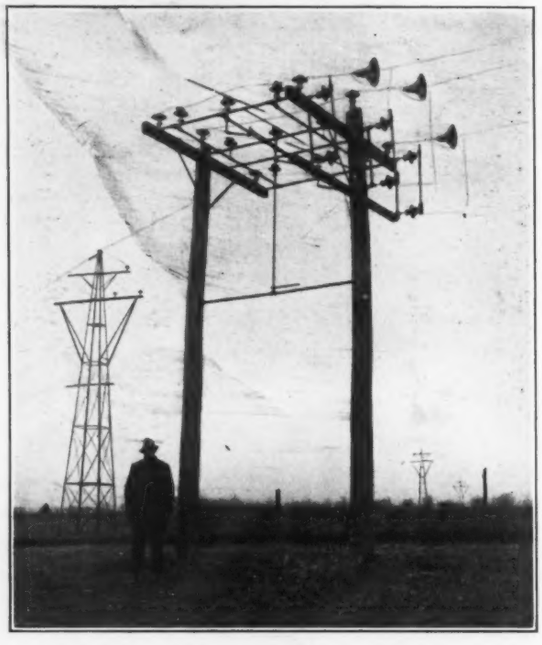


Fig. 13—Transmission Towers and Outdoor Switching Tower.

Space is arranged in the substation for motor-generator sets should it become advisable to install these to serve direct current to several present isolated-plant installations in the neighborhood of the station. By installing synchronous-motor sets and adjusting the field currents of these, it will be possible to obtain a load with leading wattless current characteristics at the station for offsetting the lagging wattless current taken by the mill and quarry motors. The substation machines would be three-unit sets, comprising 500-kw synchronous motors, each

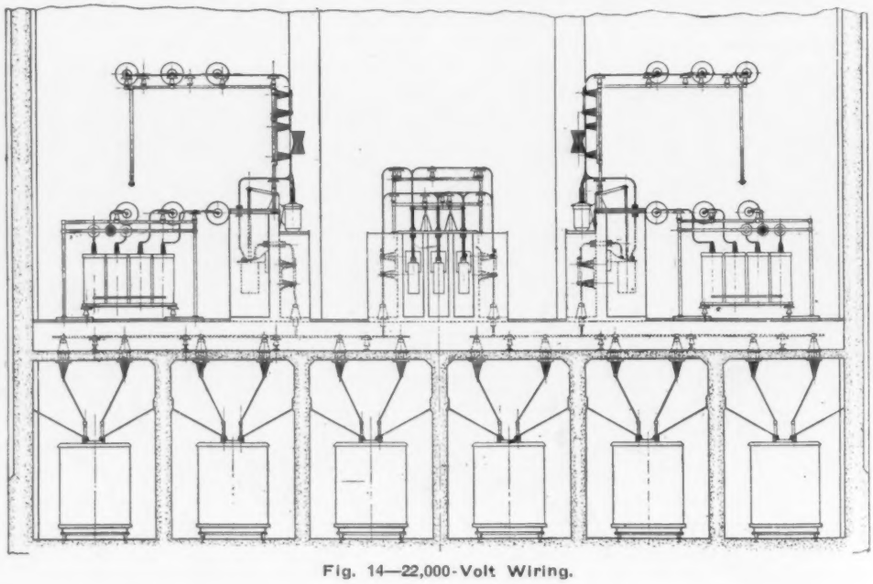


Fig. 14—22,000-Volt Wiring.

driving two 250-kw, 250-volt direct-current generators, thus making available a three-wire, 250-500-volt system. Wherever possible, however, complete equipment with individual alternating-current motors is being urged for all installations. In some instances, when the customer has a present direct-current plant, he may find it advantageous to install a motor-generator set. By using a synchronous machine for this purpose the station power-factor will be kept high.

Within a radius of 3 miles of the Bedford substation there are fifteen quarries and thirty-five mills, as has been already noted. Similar stone deposits extend 25 miles north of Bedford to Bloomington, and later it is proposed to extend the 22,000-volt transmission in a wide loop up through the district between Bedford and Bloomington, swinging back to the east and returning to the present substation, making it possible to distribute energy from Bedford in either direction around the loop in case of injury to the transmission line at any point. It is also proposed to make use of outdoor switching and transformer substations for each customer reached by the transmission loop, the transformers being arranged to step down in a single reduction from the line potential of 22,000 volts to the installation pressure of 440 volts or 220 volts.

THE STONE QUARRIES.

The famous oölitic limestone beds of the Bedford district were laid down as the old sea bottoms of the subcarboniferous period. The oölitic stone owes its name to its resemblance to masses of fish-roe or eggs, although, of course, its formation has really been due to simple concretionary action about original particles. The Bedford stone is highly valuable for building purposes on account of its fine texture and ease of working. It occurs in great beds of enormous thickness, without lamination or flaws of any kind, except occasional clay pockets and seams. Outcrops of the original stone are exposed in the bottom of stream valleys about Bedford, but the oölitic rock is elsewhere covered by an overburden of stratified limestone which forms the eroded hills of Lawrence County.

In quarrying the fine building stone the top soil and limestone burden must first be removed. For stripping the soil and soft-rock surface material a hydraulic giant similar to those used in mining and operated by a 150-hp motor-driven centrifugal pump has been successfully employed in the Bedford district. After the surface is stripped, the hard overburden is removed by blasting, leaving the valuable building rock exposed in a smooth level floor.

The first operation in quarrying this material is "channeling," or cutting deep vertical slots, forming the sides of the huge blocks, which are afterward wrenched from their footings by the derrick hoists. The cutting tools used are steel rods which are raised and lowered through about 18-in. distances 180 times a minute, meanwhile being slowly advanced across the face of the rock. By this means channels from 8 ft. to 18 ft. deep can be cut, thereby releasing blocks of similar dimensions. Steam-operated channelers have been heretofore used in the Bedford district, but electric channelers have already made their appearance and have shown performances far superior to the old apparatus. Each steam channeler requires the services of three men, and costs $12 a day to operate, including labor, coal, etc. A 12-hp motor-driven channeler, doing the same work, requires only one attendant and costs $1.50 a day for electricity to operate it. For supplying energy to the channelers at work in the pits, Greenfield conductor cable is made up into sections, with special threaded, waterproof connectors which can lie on the wet pit floor, unharmed by the rough service and moisture of the quarries. The standard electrical pressure used for this purpose is 220 volts. At the present time there are 152 steam channelers in use in the Bedford district, the majority of which will be electrified with the extension of central-station service.

After the blocks have been channeled loose from the parent ledge they are broken free of their footings by sidewise pulls of the derrick cranes, which then lift them over to the rough-stone piles for shipment to the mills. Some of the derricks used have 70-ft. masts and 60-ft. booms and require motors of from 35-hp to 12-hp rating. Squirrel-cage windings are employed where the motors drive the hoists through friction wheels. In other cases, when the hoists are directly geared, slip-ring motors are used. The demands on these hoist motors are very severe during the operations of breaking loose the blocks and hoisting them out of the pits. For the major part of the time, however, the quarry hoists run idle, taking small currents at low power-factor. Eighty such derricks and hoists are now in use in the district, a number of these being already motor-operated.

MOTOR DRIVE IN MILLS.

In some instances the stone quarries and mills are under the same ownership and operation, but it is most common for the quarries to sell the stone to separate mills, which are usually located elsewhere in the district. The quarries can be worked during only eight or nine months throughout the year, on account of weather conditions, but in this time enough rock is got out to keep the mills busy the year round. For handling the stone in the yards traveling cranes are required. These are equipped with motors averaging from 10 hp to 30 hp in rating. Sixty-eight such cranes, some steam-operated, are now in use among the Bedford mills and quarries.

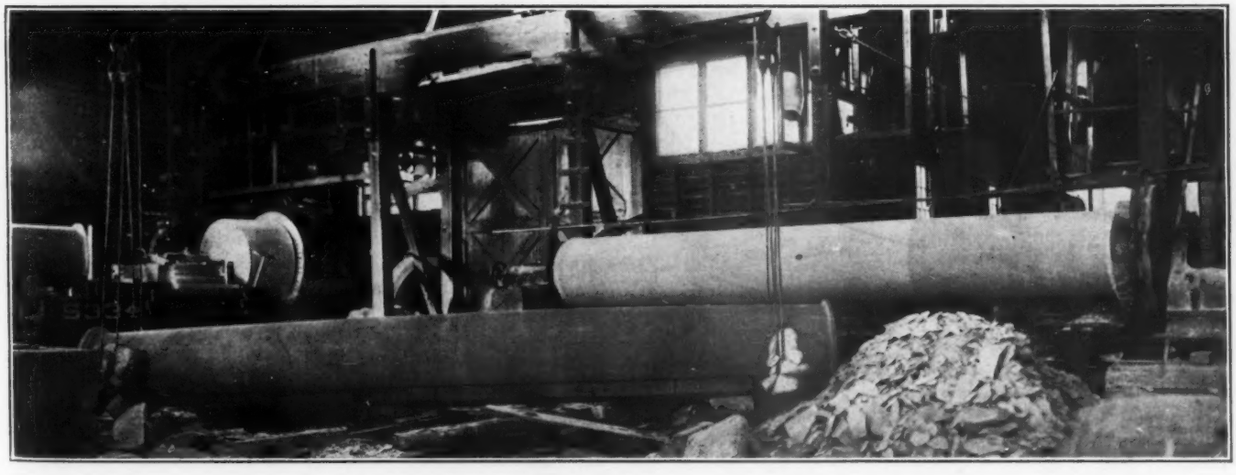


Fig. 15—Motor-Driven Column Lathe in Stone Mill.

In the mills various operations of forming and shaping the cut stone for the market are performed by a special class of machinery. The chief operation is sawing. Three types of stone saws are in use: Reciprocating gang saws, iron-wire gang saws and diamond-pointed circular saws. The reciprocating saws are of the Pitman type and comprise gangs of soft-iron blades 3/8 in. wide and about 14 ft. long, which are

oscillated horizontally over the stone with a 2-ft. stroke, 100 times a minute, being meanwhile fed into the material at the rate of 4 in. or more per hour. Water and quartz sand are fed under the blades, the sand providing the cutting action and the water cooling the blades and removing the dust produced. In some of these gang saws as many as twenty-eight cuts can be taken at one time when getting out 3-in. slabs, the thinnest used for sidewalk flaggings. A test made of such a rough saw, with six blades cutting into a buff-stone block 12 ft. long at the rate of 4.5 in. per hour, showed an average demand of 4.2 hp, with a maximum of 14.7 hp. Eight blades, fed into a 10.5-ft. block of hard limestone, at the rate of 5-in. per hour, showed a consumption of 14.7 hp. Three to eight cuts are usually made at one time; with twenty-eight blades in use, making 3-in. slabs, 45 hp would be required to drive the saw. There are 143 of these reciprocating gang saws in the Bedford district, many of them being operated for twenty-four hours a day.

In the iron-wire gang saws, iron wires, run over pulleys, are pressed into the face of the stone, quartz sand and water being meanwhile fed under the wires as before. A test of an Owen wire saw, with four wires in use making 11-ft. cuts through hard bluestone at the rate of 8 in. per hour, showed a demand of 7.2 hp on the 15-hp motor used, which will accordingly be replaced with a 10-hp motor. Sixteen iron-wire saws are in operation near Bedford.

Diamond-toothed circular saws are used for the finer work. Such saws are provided with several small black diamonds mounted in each tooth, so that the saws themselves cost several thousand dollars each. Water is used to cool the rapidly revolving blades. On test, a Myers single 76-in. saw, with four diamonds in each of its 120 teeth, while cutting a 30-in. kerf through hard bluestone at the rate of 3 in. per minute, showed a demand of 10.5 hp by its 15-hp motor. A small 3-hp motor is used to operate the feed motion for advancing the work under the saw.

Other tools for making special stone shapes are planers, lathes, headers, etc. Tests on a 38-in. planer with a 12-ft. bed showed that while 4.1 hp was continuously required for the cutting motion the demand reached 21 hp at the instant of reversing the bed movement. A 10-hp motor would, however, perform this duty satisfactorily. For making an average cut a certain stone header in a Bedford mill requiring 5 hp, showing an instantaneous demand of 17 hp for reversing. As was also indicated by the preceding test, a 10-hp motor would probably suffice for this drive. Altogether, there are 105 such planers and headers in this stone district. The size of the cuts taken on some of these tools will surprise one familiar only with metal machinery. Roughing cuts 2 in. thick and 6 in. wide are not uncommon, and several tools may be at work on the same stock simultaneously.

For making columns and round surfaces the stone blocks are turned up in lathes, in general resembling metal-working tools. The power taken by these, of course, depends on the work being done, but these machines are usually equipped with motors of from 5-hp to 7-hp rating.

The figures given in the preceding paragraphs for the motor-hp demands of various quarrying and milling operations were obtained from a complete series of tests in the Bedford district, made as a preliminary study for the Southern Indiana Power Company by Mr. C. E. Schutt, of the electrical department of Purdue University.

USE OF ELECTRICAL ENERGY IN BEDFORD DISTRICT.

In the Bedford district, within a radius of 3 miles of the substation, there is now in operation a total of nearly 13,000 hp in power-driven apparatus. Of this amount, 5000 hp is in the quarries, which are worked 10.5 hours per day, from eight to nine months in the year, and 8000 hp is in the mills, all of which operate throughout the twelve months, a large part of their machinery running continuously night and day. In fact, the average load-factor for the mills themselves, based on a 10.5-hour day, has been determined to be about 59 per cent, while for the whole group of mills supplied from the substation the load-factor may be expected to be still further increased by reason of the diversity of demand between the individual mills. The future prospective load in the Bedford district will reach 15,570 hp, including installations which are in immediate prospect. At present there is in use in the stone district a total of seventy-nine stationary steam engines and 189 portable engines, including hoists and channelers. These figures present some idea of the future load which the Bedford Power Company's plant is preparing to take over.

Electrical energy is sold to the quarries and mills according to a rate schedule by which a yearly fixed sum is paid per connected horse-power of motors, to which is added a variable charge depending on the kw-hours used. All metering is done on the secondary or the customers' side of the transformers, the latter and all equipment up to the service terminals being furnished by the central-station company.

In addition to the stone industry the Southern Indiana Power Company also sells energy to the Bedford Heat, Light & Power Company, which operates a steam-driven electric plant and supplies hot-water-heating service during the winter. As the mill and quarry demand comes chiefly during daylight working hours, the lighting load of the local distributing company will be an advantageous one for the transmission company, which is thus enabled to get off-peak business for its equipment. The transmission company is also furnishing the energy for the city pumping for the city of Bedford, operating two 150-hp motor-driven centrifugal pumps from fourteen to twenty-four hours per day.

The Esterline Company, Lafayette, Ind., of which Mr. J. W. Esterline is president, is in charge of the consulting electrical and mechanical engineering for the Southern Indiana Power Company, Mr. D. J. Angus being resident engineer on the work. The construction of the entire plant and distributing system has been done by the Mansfield Engineering Company, Indianapolis, Ind.

Mr. Horace C. Stillwell is president of the Southern Indiana Power Company, Mr. Charles E. Fletcher is secretary and treasurer, Mr. Blaine H. Miller general manager, and Mr. Fred Riebel general superintendent.

SOME ELECTRICAL TESTS OF PORCELAIN.

By Ralph P. Clarkson.

In an article published in the *Electrical World* July 7, 1910, the writer set forth briefly some facts regarding the mechanical strength of porcelain and glass, giving a description of the splendid machines placed at his disposal for the purpose of the tests. The present article is an account of some electrical experiments and is, further, a description of some very simple, but useful, laboratory-made electrical apparatus for work involving a potential of from 200,000 volts to 250,000 volts. This is without doubt the highest voltage ever used in a laboratory or lecture-room for experimental commercial purposes at a commercial frequency.

The transformer used for the tests was built at the Worcester Polytechnic Institute under the direction of Prof. Harold B. Smith, the head of the electrical engineering department and a pioneer in some branches of high-tension work. Since the writer's experiments the transformer has been entirely demolished and a new one capable of producing as high as 750,000 volts has been constructed. The same general method of winding was employed in both and a description of the unit will be of interest.

The 220-kv, 220-kw transformer was of the core type with eight primary coils—four on each leg. In each coil there were fourteen turns of No. 2 B. & S. stranded wire, making a total of 112 primary turns. In the secondary there were 100 coils of flat wire (the equivalent of No. 26 B. & S. wire) having 280 turns per coil, giving a total of 28,000 turns in the secondary winding. The terminals on each primary coil were brought out

to a slate panel bolted to the case of the transformer. From each quarter point of the secondary winding taps were brought out. Therefore, by the proper choice of connections to give various ratios of the transformer, different maximum terminal

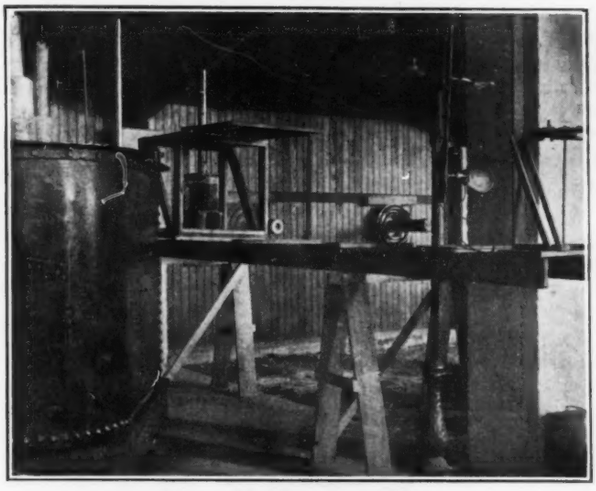


Fig. 1—The Repulsion Voltmeter.

voltages were obtainable. The midpoint of each of the two windings was grounded.

The coils of the transformer instead of being wound progressively along the core of the transformer were wound in spirals, the coil increasing in diameter with each turn, this method being ordinarily called "pancake" winding. Each winding was stitched to a plate of insulating material, and they were piled on the legs one above the other. The whole unit was contained in a large steel tank and submerged in oil. The tank was open at the top and had about 400-gal. capacity. It is shown in the extreme left of Fig. 1 and again beyond the apparatus at the right of Fig. 3.

A special voltmeter was necessary in order to read the very high potential, and one developed at the institute was carefully constructed and gave great satisfaction. The voltmeter itself is shown within the cage in the center of Fig. 1. Fig. 3 shows one of the students reading the scale and at the same time varying the potential by means of the water-barrel of variable resistance. The voltmeter is built to work somewhat on the principle of the gold-leaf electroscope and consists essentially of a swinging plate hung parallel to a similar fixed plate and electrically connected to it, the whole being immersed in oil. The swinging plate carries a mirror and by means of a small telescope the reflection of a scale placed some distance away may be easily read in the mirror and thus the relative deflection

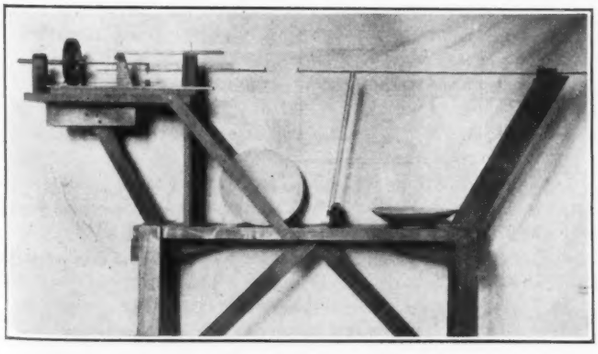


Fig. 2—The Spark-Gap Apparatus.

due to the repulsion between the charges carried by the plates may be read exactly as in an ordinary galvanometer. The incandescent lamps for lighting the scale and the scale itself may be seen in Fig. 1. The scale is fastened just to the left of the forward end of the telescope and the lamps mounted for convenience of operation on the portable base in front of the scale in such a way as to be vertically adjustable also. The immersion of the plates in oil not only insulated them, but very effectually dampened the movement of the swinging plate and made the instrument practically dead-beat. The glass jar containing the plates was fixed on an insulating standard in the geometrical center of a grounded wire cage through which an insulating tube passed for the entrance of the wire from the voltage source. The wire cage kept the plates at a definite and fixed distance from the "earth" and created a uniform field surrounding the voltmeter. As a precaution the entire roof of the laboratory was covered with wire netting.

To calibrate the repulsion voltmeter on very high potential work, such as this proved to be, it was necessary to compare it with some standard of voltage measurement and the spark-gap was the only standard of sufficient accuracy obtainable. Fig. 2 shows the instrument used for measuring the sparking distance. It consists of a stand with one fixed and one movable socket, each of which is adapted to hold securely and electrically contact with a pointed needle (ordinary sewing needles were used). By means of the micrometer wheel at the left the distance between the needle points could be adjusted and accurately determined. The potential necessary to jump the gap

Fig. 3—Method of Reading and Varying Voltage.

formed was taken from a carefully prepared curve obtained from the American Institute of Electrical Engineers. Fresh needles were used for each gap, but in the calculations no account was taken of the condition of the air nor the pressure near the gap of the glass supporting rod shown in the photograph. The diagram of connections is given in Fig. 4.

A section of the water-barrel of variable resistance is shown in Fig. 5. It proved itself a quick and convenient device for the purpose and, being of some novelty, is worthy of mention. The sketch is self-explanatory, the movable terminal *C*, which is an iron plate, being moved by means of the handle *A*, which may be held in any desired position by inserting the wedge *B*, as shown. The stationary terminal is *D*. The resistance material between the plates is salt water and the instrument may be made as delicate as desired by changing the amount of salt.

Numerous preliminary tests were made on several selected types of high-tension insulators for the purpose of finding how the breakdown occurs most often under very high potential. It was found, as expected, that in every case the first thing that occurred was a substantial surface leakage, which was usually

followed by the arc. Only those who have been permitted to see the breakdown of a high-tension insulator can realize the intensity of the occasion and the thrill of mingled awe and fear which passes through the spectator. The hum of the transformer, first low and dull, then gaining in volume and sharpness of tone, intermingling with the deafening crackling of the current as it leaks around the insulator and jumps from point to point, the smell of ozone in the air and the beautiful forms and colors of the corona—then a rippling lighter sound when the arc appears and the metallic click as the circuit-breaker blows—all gives one a sense of helplessness as he thinks of how little has been learned about the control of electricity and how much there is to know!

After the preliminary tests it was desired to find something of the potential necessary to puncture porcelain and the effect of the glaze upon the voltage required. The results are shown in the accompanying table. In order to make the tests a large number of plates, such as are shown on the sparking standard in Fig. 2, were obtained from one of the largest and most successful insulator houses in the country. The plates were all of the same batch and, while made up especially for these tests, were from a standard line of porcelain. Some of them were glazed as in the commercial product. They were 10 in. in diameter, dished shape and ¼ in. thick at the center, tapering slightly to the edge.

The plates were placed between two terminals consisting of brass balls of ¾-in. diameter placed at the center of the plates. In the case of the glazed specimens the lines of force—that is, the preliminary leakage—formed around the plates at a certain

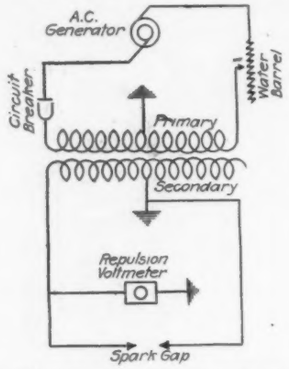


Fig. 4—Diagram of Calibration Connections.

potential which was carefully noted. The same plates were then placed in oil and the same terminals arranged as before. In this case, of course, the voltage caused a puncture, the oil preventing any sparking around the edge and over the surface. With the plate in oil, several determinations were taken with each plate to find the voltage at which the puncture took place and every time a determination was made the puncture resulted at another point than previously, the current breaking a new hole instead of passing through the hole first made, although the voltage required to jump a gap in the oil equal to the thickness of the plate was found by subsequent tests to be less than that required to puncture the porcelain. This action appears unexplainable without further experiment. It would be interesting to know just what occurs in the hole in the porcelain immediately after it has been made by the passage of the spark. Why should the plate be punctured at another point rather than the arc passing through the same path?

In air the unglazed plates showed very quickly their impracticability for high-tension work, the leakage of lines of force being through the pores of the plate in every direction. The plates were not punctured and no arc was formed, simply a continuous crackling and passing of sparks through the plates from one terminal to another by various paths. This sparking took practically no additional current as does the current arc. When the potential was raised the plates were not punctured, but the arc formed around the edge. In oil, however, the puncture and formation of the arc took place with the first spark that passed, no preliminary discharge occurring. The mechanical tests described in a previous article showed the advantage mechanically of glazing the insulators and these electrical tests brought out very sharply the absolute impossibility of using an unglazed insulator on high-voltage work.

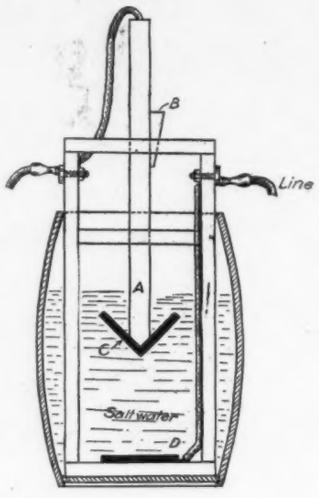


Fig. 5—Water-Barrel Resistor.

Without doubt the surface leakage is the important factor in the breakdown of insulators and any method of decreasing the tendency toward such leakage cannot fail to be of value. The first long step in that direction was the application of glaze to the insulator, then the leakage path was made as long as mechanical strength would allow. A limit was reached in a single insulator and the multiple-disk type of insulator was evolved. That has many distinct disadvantages over the pin type of insulator and, without doubt, a great many advantages. It is seemingly the only adequate insulator for very-high-tension work at present. However, the writer desires to offer as suggestive a few experiments made between November, 1907, and May, 1908, with what at that time, so far as he knows, was a new idea in insulator design, but which has since become somewhat differently developed in the condenser type of insulator, although when that name is used it is usually applied to insulators having alternate layers of insulating and conducting materials.

The following experiments have not been supplemented by further work owing to lack of time, but they may be regarded purely as simple, elementary suggestive work which carefully considered and diagnosed will point the way to a further development of insulator design.

The idea which prompted the work was to cause a redistri-

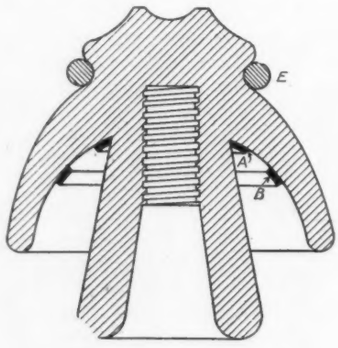


Fig. 6—Insulator.

bution of the electrostatic field surrounding the insulator by placing some capacity on its surface. For a while tinfoil was used, but it was very difficult to fasten this to the surface of the insulators, so aluminum-bronze paint was obtained and that could be applied and dried very readily. It was found that the

presence of the metal on the surface of the insulator does make a difference in the surface leakage and the difference is not in proportion to the difference of length over the surface that the spark follows, assuming the paint to be a continuous conductor and the distance of leakage to be the total distance the spark follows minus the length of metal over which the spark passes.

To show one effect of the application of the metal an experiment was performed as follows:

Two insulators, identical in every respect, as far as could be seen, were made by the same company from the same batch of clay, of the same dimensions throughout and had withstood a salt-water test of the same voltage on the same day. They

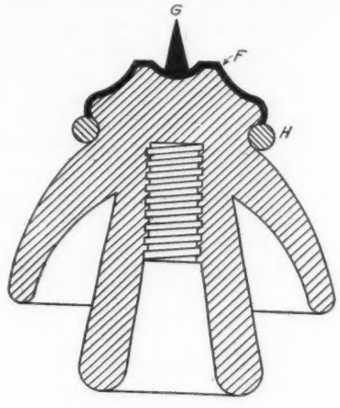


Fig. 7—Insulator.

were as near alike as it is possible to get insulators. Each insulator had a single petticoat and was formed about as shown by the sketch.

On one of these two strips of the metal were painted entirely around it as located by *A* and *B* in Fig. 6. Each was ¼ in. wide, and the distance between them was ½ in. The two insulators were placed on the stand together. The unpainted one sparked over at 66,000 volts, while the painted insulator sparked over at 74,000 volts. Both were then carried up to the arcing point and the painted one punctured close up to the joint at *A*, while the other arced around the edge of the petticoat. Several other tests were made with other insulators and the same conditions prevailed. A second experiment was performed in which a cap of metal was painted on the insulator, as shown in section in Fig. 7, by the very heavy line at *F* extending down to the test conductor at *H* and touching it all around the cap. A sharp cone-shaped pointer was placed at the top of the insulator and electrically connected with the metal *F*. In the dark at the point *G* there was found a bright corona which amounted to a blue flame when the voltage was raised sufficiently, the leakage being very great and at that point only.

RESULTS OF EXPERIMENTS.

	Glass.	Porcelain.	
		Glazed.	Unglazed.
Tensile strength in pounds per square inch.			
Average	1,044	1,410	1,096
Lowest	563	870	587
Highest	1,415	2,142	1,923
Compressive strength in pounds per square inch:			
Average	No tests	9,034	14,233
Lowest	.....	5,780	7,200
Highest	.....	17,580	19,450
Average dielectric strength in volts per millimeter. Sharp needle points in oil	.....	16,440	13,680
Leakage distance around edge of porcelain disk	.....	29 mm.	29 mm.
Voltage required to cause first sparking around	.....	52,000	49,500

The third experiment abolished the pointer and in its place a saw-toothed edge was painted around the bottom of the cap extending slightly below the conductor *H*. The leakage was then entirely from the points of the saw teeth, of course, and in the dark the corona at those points was very much in evidence. The points were then embedded in insulation with the result of great modification of the corona; in fact, it was almost entirely averted.

One great difficulty with the use of the aluminum paint in this connection was the blowing action of the sparks, which acted to destroy the sharpness of the various lines and to cover parts of the insulator with fine powder. For that reason the experiments were very long, the insulator having to be cleaned very frequently and each time the paint was applied quite an appreciable time was taken for the drying action.

ACUITY.

By Sydney W. Ashe.

So much attention is being attracted at the present day in illuminating discussions to the subject of "acuity" that the following article has been prepared with a view to giving a simple outline of the subject.

Acuity is a measure of one's ability to perceive detail. Acuity is usually determined by means of a Snellen's chart of test type, which contains rows of various-sized letters. Opposite each row of letters on this chart is marked the reading distance in meters and in feet. If an individual is just able to read the letter at the distance indicated, he is said to have unit acuity. The chart which is illustrated in Fig. 1 has a total height of 28.5 in. The letter *T* at the top is 3.06 in. wide by 3.5 in. high.

Snellen arranged the letters on this chart so that they would be distinguishable by the normal eye under an angle of five minutes. Assuming that the nodal point of the normal eye from the retina is 15 mm, the angular size of the minute corresponds to

$$\frac{2\pi 15}{60 \times 360} = 0.004 \text{ mm}$$

A five-minute angle would, therefore, correspond to a distance of $0.004 \times 5 = 0.02$ mm on the retina of the eye. It is clear that letters intended to be seen at a distance of 12 m must have double the lineal size, according to this angular relation, of those which are seen at 6 m.

In measuring acuity it is necessary to select a particular size letter, illuminate it with normal intensity and determine the distance at which an individual can read this letter.

Representing the distance in millimeters of the observer from the chart by *D* and the height of the letter in millimeters by *S*, the relation will be expressed for unit acuity as follows:

$$D = \frac{15\ S}{0.02}$$

Given a certain letter on one of the lower lines of a Snellen's chart, the height of which letter is 4.10 mm, it is obvious that an individual having unit acuity should be able to read this letter at 3 m, for

$$D = \frac{15 \times 4.1}{0.02} = 3000 \text{ mm.}$$

In a measurement made by the writer this particular letter was illuminated with 61.4 m-candles (5.8 ft.-candles) intensity by a clear 16-cp lamp 50 cm (1.5 ft.) from the chart. The distance at which the writer was able to read this letter was 3.04 m. The measure of the writer's acuity is, therefore, the relation which exists between the normal distance, 3 m, for unity acuity and his reading distance, 3.04 m, or his acuity is equal to 1.01.

The acuity varies with the intensity of the light upon the

illuminated chart, and it varies also with the color. According to the accompanying table it will be noted that the acuity in the above-mentioned test varied from 0.68 with a foot-candle intensity of 3.84 to 1.38 for a foot-candle intensity of 383. These readings were taken with an ordinary 16-cp carbon lamp.

Foot-Candle Intensity.	Acuity.
383.0	1.38
171.0	1.24
96.0	1.06
61.4	1.01
15.3	0.90
3.84	0.68

It will be observed, therefore, that the acuity is not constant, but varies with the intensity.

Fig. 1—Snellen's Chart Reduced to About One-Sixth Full Size.

The relation between acuity and intensity can be shown by means of the curve of Fig. 2. The ordinants of this curve measure the acuity and the abscissas measure the intensity. At *o*, for instance, there is zero illumination. At *a* the illumination has been raised so that vision is beginning. From *a* to *b* with a small variation in intensity the eye has reached practically maximum acuity, and from *b* to *c* throughout the wide range of illumination the acuity is only slightly changed, being maximum at the middle, the acuity falling rapidly to zero from *c* to *d*, where the intensity is about that of the sun. The point *a*, or the lowest point of visibility, is called the threshold (Reizschwerte). From *b* to *c* the illumination follows the law of Fechner—which will be stated later—quite closely, but not exactly, for the line is not a straight line, reading its maximum point at *M*. Bouguer knew of this relation for many years, but Fechner at the commencement of the eighteenth century expressed it in the form of a law. Aubert was the one who determined the threshold for the normal eye; the weakest light he was able to distinguish was that on a sheet of white paper illuminated by a candle at a distance of from 200 m to 250 m. In determining his value it was necessary to bandage the patient's eye in a dark room for at least twenty minutes. The fraction in normal persons according to Fechner varies between 0.010 and 0.0055. The acuity of our light senses may be expressed by the inverse fraction of Fechner. If, for instance, the latter be 1/100 it may be said that the acuity of the normal eye is equal to 100. If the illumination is greatly diminished and the fraction rises to 1/50 it is said that the acuity is 50. The law of Fechner is that which shows the sensitiveness of the eye to visual impressions. It is stated by Helmholz practically as follows:

Within very wide limits of brightness differences in the light strength are equally distinguished, or appear equal in sensation, if they form an equal fraction of the total quantity of light compared. In other words, if the parts of the visual field have the same relative brightness, the distinction of detail does not vary materially with great changes of absolute brightness.

Dr. Louis Bell, in "Art of Illumination," calls attention to the fact that Fechner's law fails when extremely brilliant lights are concerned. "Few persons realize, for instance, that the sun is twice as bright at noon as it is when still from 10 deg. to 15 deg. above the horizon. Yet while the eye does not detect very small changes or properly evaluate large ones in a body so bright as the sun, the mere fact that one can see to work or read about equally well from sunrise to sunset is most convincing as to the general truth of the law. Full sunlight at noon is generally overbright for the eye if it falls directly upon the work, but with half of it one can get along very comfortably."

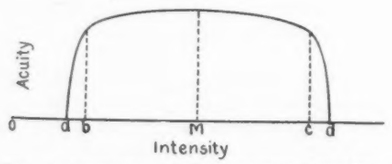


Fig. 2—Variation of Acuity with Intensity.

Given an ordinary stick supported in a vertical position illuminated by two equal light sources at *A* and *B* (Fig. 3) placed at different distances from the stick, each will cast a shadow upon the wall near which the stick is placed. Calling these two sources *A* and *B*, *B* may be moved away from the screen, becoming weaker and weaker, and when the distance of *B* from the screen is nearly ten times that of *A* its shadow ceases to be visible. Assuming *B* is 500 cm and *A* is 50 cm when the shadow is indistinguishable the following relations exist as to the perception, the final result being Fechner's constant:

$$\left\{\frac{1}{50^2}+\frac{1}{500^2}\right\}-\frac{1}{50^2}=\frac{1}{500^2}$$

$$\frac{\frac{1}{500^2}}{\frac{1}{50^2}+\frac{1}{500^2}}=\frac{1}{10^2+1}=\frac{1}{101}$$

With ordinary lamps the law of Fechner may be verified with great exactness, although, as shown in the previous curve, it does not hold for lower and higher light intensities.

STUDIES ON ACUITY.

The first person to study the relation between visual acuity and illumination was Tobias Mayer, who reported his results in 1754. He formulated the law that acuity varied as the sixth root of the intensity of illumination. Reviewing results obtained by Mayer, Posch, Albertoti and Carp, and himself, Cohn states that enormous individual differences in visual acuity are found with the decrease of the intensity of illumination. (*Arch. f. Oph.*, 17, page 305, 1871.)

Uhthoff and Koenig have probably made the most careful investigations of the subject. They varied the intensity of

illumination from 1 to 3,600,000. As a source of light they used a 4-cp petroleum lamp. The lowest visual acuity obtained was 0.0015. The maximum acuity was reached with an illumination of 33 m-candles. In his study Cohn found that it was useless to take observations with daylight as a source of light, inasmuch as the eye does not by any means show the difference which the photometers show—that is, within certain limits

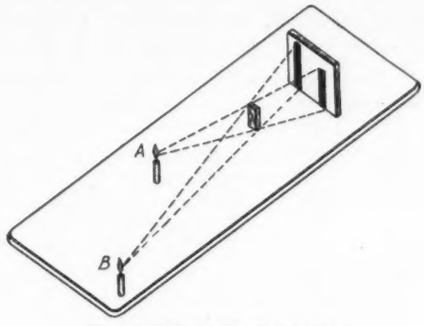


Fig. 3—Bouguer's Principle.

the low variations of the intensity of the illumination are not attended with any notable difference in acuity.

In some studies made by Cohn he found that some eyes had full acuity at only 1.5 m-candles, and one-half acuity at only 0.6 m-candle of illumination. All of the eyes tested had full acuity at 16 m-candles and one-half acuity at 4 m-candles. Dissatisfied with the observations found, Cohn repeated the observations with a number of persons and took the average of all of the readings obtained. For $a = 1$ or unit acuity the intensity was 100; for $a = 0.75$ the intensity was 71; for $a = 0.5$ the intensity was 0.33. More recent and accurate observations made by Koenig on his own eyes with white and colored lights led to the formulation by him of the following expression:

$$S = A\ (\log B - \log C),$$

in which the constant C is inversely proportional to the intrinsic brightness (helligkeitswerthe) of the lamp used. The factor A, on the other hand, is independent of the nature of the lamp. A and C may, however, be essentially different according as cones or rods serve to receive the light stimulus. In the first case A may be ten times as great as in the second. Koenig argued on the basis of the relation of the acuity to increasing intensity of illumination, wherein there is seen a high increase with low intensities and a less rapid increase with high intensities, and that in acuity the different sorts of elements of the sensitive layer of the retina are involved. The first kind are with the lower intensities which are relieved by the second kind even before they have reached the upper limit of their ability with the increase of intensity; the second likewise increase in their power until they have reached their limit. Koenig states as a matter of fact in the determinations which belong to the slowly ascending portion of the acuity curve that fixation is not made with the fovea, but somewhat eccentrically with the increased intensity of illumination; with the more rapidly ascending part of the acuity curve, however, fixation is made with the fovea. With a totally color-blind eye, which Koenig tested, the whole course of the curve corresponded with the slowly ascending part of the curve of the color-perceiving eye, and Koenig concluded from this that incapacity of the cones of such an eye is also the cause of the low acuity constantly associated with this anomaly.

AN IMPROVED FORM OF PRONY BRAKE.

By H. G. Crane.

The brake shown in the accompanying illustrations was designed for the electrical engineering laboratory of Harvard University and has been successfully employed in testing motors of from 1 hp to 10 hp. Several features of this brake are entirely new so far as is known. The illustration, together with the following brief description, will convey an idea of its construction and operation.

Ordinary forms of oil dash-pot, spring-balance and water-cooled brake drum are used. As will be seen by referring to Fig. 2, a small four-wheel carriage rides upon the drum. This carriage is movably attached to the brake arm by means of two studs SS' and retaining springs AA'. A hand wheel W operates a screw which passes through a metal bushing B in the brake arm as shown. This screw bears directly against the top of the carriage at C. A steel brake band, lined with camel's-hair belting, encircles the brake drum and is adjusted in tension by means of studs DD'. When the screw W is turned the arm is forced away from the carriage and the brake band brought into contact with the drum with adjustable pressure. At minimum load position the brake band hangs free from the drum and the rotating wheels exert only a slight turning effort on the brake arm, due to their small friction.

The weight of the arm may be counterbalanced, if desired, in order to allow for its effect on the reading of the balance. The zero reading is easily obtained, however, without counterbalancing, by rotating the drum first in one direction, then in the other, and noting the mean position of the scale pointer. The counterbalancing becomes important only when a heavy brake arm is used. As the hand wheel and screw are directly over the center of the shaft, the operator may rest the weight of his hand on it and hold the load constant at any desired point, without causing sensible error in the balance reading. The carriage, when properly made, may be used interchangeably on drums of various diameters. The outlines of two drums are shown in Fig. 2.

Although the small composition metal wheels EE' (2-in. diameter, 1-in. face) may sometimes revolve at extremely high

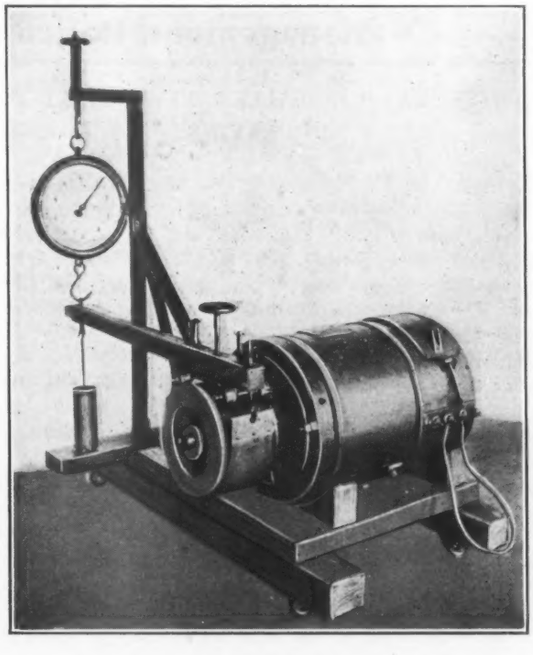


Fig. 1—An Improved Form of Prony Brake.

speeds, no difficulty has been experienced with their lubrication. A drop of ordinary machine oil, mixed with a little graphite, will serve for a considerable time. These wheels are mounted on a ½-in. shaft, and, to provide for wear, may be fitted with renewable bushings.

The illustrations show the brake mounted on the pulley of a small motor of the automobile type. The zero reading due to

the weight of the brake arm, dash-pot plunger and adjacent parts is about 1-lb. weight. A screw enables the brake arm to be kept horizontal at all loads in spite of the variable distention of the spring in the spring balance. Fig. 3 shows an end view and longitudinal section of an ordinary form of brake drum. After bringing the motor up to speed, and before the load is applied, water is poured into the chamber within the drum. As is well known, centrifugal force during the running of the motor prevents the escape of this water, but in order to check the escape at starting or stopping the end apertures of the drum may be nearly closed over, if desired.

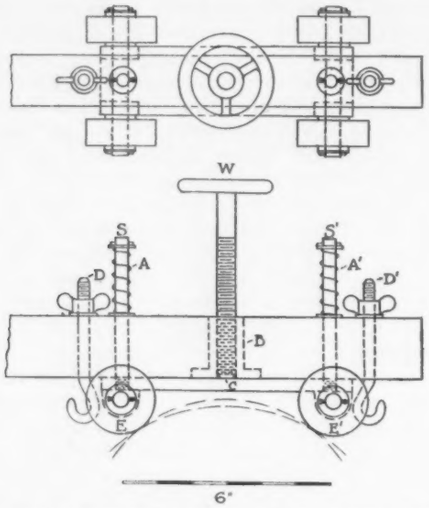


Fig. 2—Plan and Elevation of Brake Carriage.

The special advantages of this type of prony brake are:

(1) The ease with which the frictional load can be applied and completely removed, the brake thus being applicable to even the smallest motors, with which even a small initial frictional load would be very objectionable.

(2) The ease with which the frictional load can be varied and controlled by resting the hand on the screw wheel *W* in such a manner as not to alter the frictional couple, the axis of the wheel passing through the axis of the motor shaft when the brake beam is kept horizontal.

(3) The construction is such that the brake may quickly and conveniently be shifted from one motor to another.

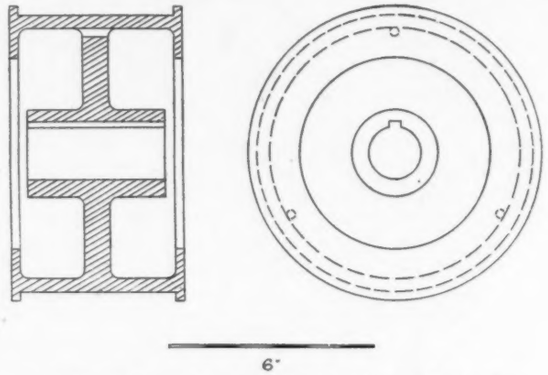


Fig. 3—End View and Longitudinal Section of Brake Drum.

Central Station
Management, Policies and Commercial Methods

"WHITE WAY" INSTALLED WITHOUT DISTURBING PAVING.

At Enid, Okla., a "white way" has been installed about the public square, comprising sixty ornamental iron posts at 50-ft. intervals, each carrying two 40-watt and one 60-watt tungsten lamps. The lower 40-watt lamps burn until midnight, while the 60-watt lamps at the tops of the posts are operated all night long. The cost of the electricity for operating the lamps is met by the city.

In laying the 1¼-in. iron conduit under cross streets all tearing up of paving was avoided by forcibly thrusting the pipe through the subsoil. The pipe end was first capped to keep it from filling with dirt, and then by means of a lever-operated jack the pipe was driven through the loam beneath the pavement. By sighting the pipe for a given point on the opposite side of the street it was found possible to reach the target within a few inches when the pipe was driven. Mr. Lincoln Beerbower is manager of the Enid Electric Company.

DISCOLORATION OF ICE BY USE OF BOILER COMPOUNDS.

Many combination ice-electric plants using boiler compounds having soda ash as a base have noticed a tendency to discolor the distilled-water condensate to a reddish hue, resulting in making "red" ice. Obviously, none of the pigment material can come over with the steam from the boilers, and some operators have been at a loss to know how the presence of the boiler compound could affect the color of the ice. The manner in which the discoloration occurs was outlined by Prof. A. C. Scott in a discussion on feed-water purification before the recent convention of the Southwestern Electrical Association at Houston, Tex., April 28. The soda ash, explained the speaker, liberates carbon dioxide in the boiler. Carbon dioxide, being a gas, comes over with the steam, and when the latter is condensed causes the formation of carbonates. These in turn are converted into hydrates, which may attack the iron in the walls of the container, rusting them and producing the reddish iron oxide which causes the discoloration.

In the discussion of this paper dealing with feed-water purification several small-plant operators brought out the point that they had employed successfully boiler compounds composed of the juices of Irish potatoes, which introduced none of the drawbacks of other scale preventives. Mr. W. B. Tuttle, of San Antonio, Tex., declared that any small plant having feed-water troubles would do well to install filters or other means of purification and treat the water before it enters the boilers.

NEW-BUSINESS METHODS IN NEBRASKA.

Mr. C. J. Snyder, of the Omaha Electric Light & Power Company, in a paper before the Nebraska Electrical Asssociation convention at Lincoln in April, told of some of the successful new-business methods used in Omaha. He said that the solicitors in Omaha divide their attention between new and old houses. The wiring of new houses is so generally taken as a matter of course that this part of the work is easy. More effort is required to secure the wiring of old houses. The company has been very successful in that respect, however.

In 1909 1000 old houses were wired and in 1910 1227. In working for this business solicitors always take houses on existing service lines. One of the street-car "ads" which have

been most effective in securing the business of wiring old residences was shown, the wording of this advertisement being:

"1227 OLD HOUSES WIRED LAST YEAR. WHY NOT YOURS?"

He then outlined the arguments used by solicitors in displacing steam and gas engines with electric motors. Heating appliances and rectifiers used for automobile charging are considered as non-peak load and, not being figured with the connected load, come on the secondary portion of the bill at a low rate. The company uses street-car and newspaper advertising liberally as it has but a small showroom in which to make a display. Small repairs are made free on electric irons. As a competitor the crude-oil engine has shown itself very economical, but it requires a special operator, and 20 per cent maintenance and depreciation should be figured off each year.

DISCUSSION.

Mr. B. C. Adams, of Lincoln, said that the advertising of the Omaha company in Omaha papers helped all of the electric-lighting companies in the State by advertising electric service in a general way, because the Omaha papers circulate in all the small towns.

Mr. C. C. Smith, of Exeter, Neb., told of methods used in his town, where boys were sent out with push cars delivering electric irons for free trial. He invited the business men to a dinner and proposed a decorative street-lighting scheme. This was carried out with small-candle-power tungsten lamps connected in series multiple as in sign work. The effect was very pleasing. A number of connections had been made specally for operation of electric fans in sick-rooms. He had promulgated the idea that the housewife is more entitled to an electric fan in working about the kitchen than is the business man in the office, with the result that business men had to take their fans home and buy others for the office.

Mr. S. G. Peticolas, of the Westinghouse Electric & Manufacturing Company, Omaha, said that manufacturers are now training men to help central-station men in getting the more important motor business. One company has collected a large amount of data on different motor installations for aid in getting this business.

Mr. B. C. Adams, of Lincoln, said that the small tungsten lamps of low voltage had opened up a new field in sign and decorative lighting, especially in smaller towns and with storekeepers of small means. He cited an interesting case at O'Neil, Neb., where, because of the street being lighted up from the depot to the hotel, the hotel manager noticed such a falling off in bus traffic that he had about concluded to discontinue the bus.

Mr. J. G. Boyd pointed out that there is not only a 5-watt tungsten sign lamp now available, but a 2.5-watt lamp.

CENSUS TABULATING MACHINES FOR STUDYING CUSTOMERS' ACCOUNTS AT ST. LOUIS.

The Union Electric Light & Power Company, St. Louis, has been engaged in making a study of its customers' accounts, investigating the individual and aggregate incomes from various classes of service and the desirability of each kind of business. To aid in studying the thousands of items involved in the monthly bills of its 28,000 customers use has been made of the census type of tabulating machines developed first for the use of the bureau at Washington and employed later for various accounting purposes. With these machines, as will be fully described further on, cards are punched with perforations corresponding to certain data of the customer's monthly bill, and these cards are then electrically separated and finally counted by contact needles in the tabulating machines.

The form of card used is shown in Fig. 1. The first column represents sections of the city, which are further districted by the numbers in the next column. The narrow numbered column gives the months of the year. Street names in the districts are indicated by combinations of letters, and numbered streets by the figures in the next column. The capital letters A to G in this column are used to designate flats or apartments in the same building. The following column shows the house number and the column headed "Class Number" indicates in which one of 250 classifications of businesses the customer is engaged. There are 100 lighting classifications and 150 motor classes, power customers being classed according to the uses of their motors—sewing machines, elevators, etc. The next

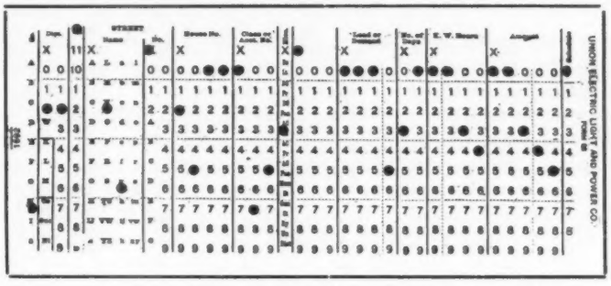


Fig. 1—Tabulating Card Punched for Customer's Electrical Consumption.

narrow column shows the kind of energy and the purpose for which it is used.

An extra three-figure column following this has been provided for any purpose that may be desired later, such as the account number, demand, net average rate per kw-hour, or other data. The customers' ledger cards of the Union Electric Company are filed in geographical or street order, instead of by account numbers, so that it becomes very easy to find any account from a card by referring to the street location. The column headed "Load or Demand" has been used for total connected load, as the company has no maximum-demand meter installed and had no way of arriving at these data. "No. of Days" refers to the interval between two consecutive meter readings, "Kw-hours" represents the monthly consumption, and the last wide column gives the amount of the monthly bill.

The schedule of rates under which the customer obtains his service is shown by the extreme right-hand single-figure column. Where a column group contains no numerical data a single perforation is made over the X at the top, causing the card to be distributed into a special box.

The card shown in Fig. 1 was punched for the December bill of a small grocery store having an installation of ten 16-cp lamps. Beginning at the left, the information punched on the card is as follows: Section H, District 22, of city. December bill (12th month). North Grand Avenue (Ng). House number 2500. Classification number 75, denoting grocery. Kind of service, alternating-current lighting. Blank column. Connected load, 0.5 kw. Days' interval between meter readings, 30. Kw-hours consumed, 34. Amount of bill, $3.45. Rate schedule, Standard.

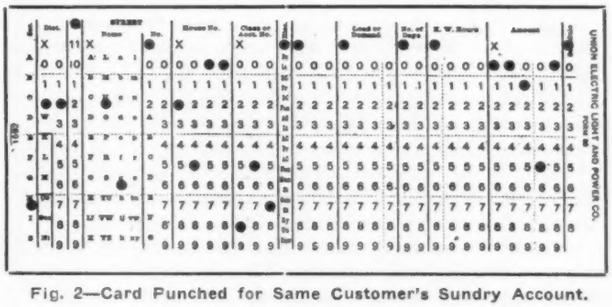


Fig. 2—Card Punched for Same Customer's Sundry Account.

The card in Fig. 2 was punched for a small sundry charge to the same customer. The left-hand side of the card is perforated as before, but the classification number gives way to an account number, 857, indicating the character of the purchase, in this case lamps. All the remaining columns are cleared by punching over the X marks at the top of the columns, except in the case of the amount of the purchase of the lamps, $2.50.

The customers' monthly cards are perforated in a special punching machine arranged with keys like a typewriter and having an automatic spacing device for advancing the card, column by column, as each column is punched. For punching a number of cards in the same district of the city a gang punch is provided in which the dies can be set permanently and as many cards as desired perforated alike, with section, district, month and street, without the tedium of locating each separate punch-hole.

After the cards are punched they are taken to the Hollerith sorter, shown at the left in Fig. 3. This is an electrically controlled motor-driven machine which can distribute 200 cards per minute into eleven different classifications. The sorting is done by an electrically charged needle, under which passes the column for which the card is to be sorted. On reaching the punch hole the needle makes contact through it with a brass roller beneath, closing an electric circuit which opens the assorting slot corresponding to the distance the card had moved before the needle reached the hole. Into this slot the card is carried, being delivered into the corresponding box by a belt carrier. The assorting needle is on a movable slide carriage, and can be adjusted to cover any column. For example, the first sorting is usually done with respect to class of service.

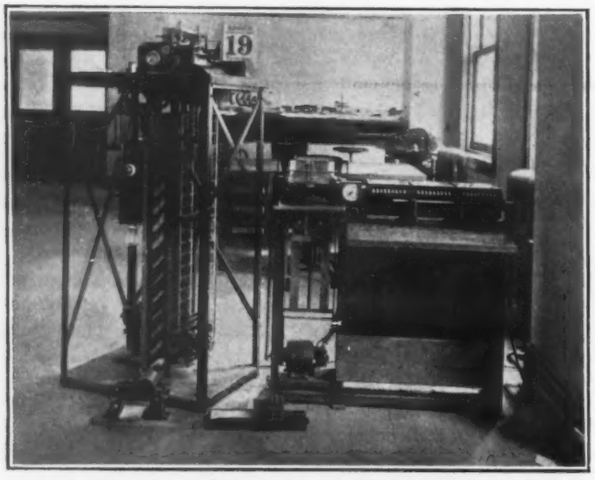


Fig. 3—Sorting Machine, Tabulating Machine and Punches.

The needle would then be set opposite the column marked "Elec," and when the card shown had passed seven-tenths of the way through the sorting mechanism the needle would make contact with the brass roller, opening the seventh slot, into which the card would fall, to be delivered into the box with all the other cards punched for "AC lighting." If it is next desired to divide these alternating-current lighting customers among the 100 classifications of business, the cards from the "AC lighting" box would be run through the sorter again, with the needle set first opposite the units column in the "Class" division. Our grocer's card would then come out in the "5" box, with the cards of a number of other businesses whose designation number ended in 5. These "5" cards would then be sorted for the tens column, our grocer's card appearing in the "7" box with those of all the other grocers using alternating-current lighting. A little consideration will show that considerable time is saved by sorting from the units side of the numbers first.

If it is now desired to find the total or average, connected loads, consumptions or monthly bills of this class of service, these alternating-current-lighting grocers' cards are taken to the tabulating machine, shown at the right in the illustration. This machine counts and adds three separate four-figure sums on the cards at the rate of 150 a minute. Contact needles similar to those in the distributor are employed in the tabulator, closing circuits to the contact cylinders beneath, as they penetrate each hole. The distance to which the card has just passed before making these contacts controls the figure which is counted on the registering dials in each case. There is, of course, one needle for each place in each of the columns to be added, and the counters are arranged with carrying attachments so that each rotation of a counter moves the next counter up one place. The tabulator used by the Union Electric company is arranged to add in separate sums the columns denoting connected loads, monthly consumption and amount of customers' bills. As each card passes through the tabulator it is counted by a register, enabling class averages to be deduced quickly by dividing sums total by the number of customers.

By the use of these tabulating machines the St. Louis company has obtained some interesting information about the average income from the various classes of customers it serves. For example, the results of the investigation show that the consumers living in the fashionable apartment buildings are nearly as good customers as those in private dwellings, while the per-customer consumption in flats, or the lower class of apartments, is less than that of either of the preceding classes. The average connected loads for these three classes of customers are as follows: Flats, 16 lamps; apartments, 20 lamps, and dwellings, 32 lamps. The average hours' use of the connected load of residence lighting customers in St. Louis varies from 0.36 hour per day in summer to 1.2 hours in midwinter, maintaining an average of 1.2 hours per day for the entire year.

In the table printed above is given a compilation of some of the data secured with the aid of the Hollerith tabulating machines in St. Louis.

AVERAGE CONNECTED LOAD AND HOURS' USE OF PART OF ST. LOUIS LIGHTING CUSTOMERS.

CLASS OF BUSINESS.	NUMBER OF CUSTOMERS STUDIED.		AVERAGE CONNECTED LOAD IN KILOWATTS.		AVERAGE HOURS USE OF CONNECTED LOAD PER MONTH.	
	Alternating Current.	Direct Current.	Alternating Current.	Direct Current.	Alternating Current.	Direct Current
Residence.						
Apartments	1,632	...	1.	...	24.2	...
Flats	6,166	...	.8	...	20.5	...
Houses	7,155	...	1.6	...	20.6	...
Commercial.						
Banks	12	11	1.7	16.8	55.5	87.8
Billboards	6	10	1.6	14.7	157.7	105.5
Billiards, pool, bowling	84	35	1.5	2.0	97.9	185.8
Churches	177	8	6.4	9.4	12.8	18.1
Clubs	92	13	5.5	7.9	53.3	131.4
Commission houses	24	129	.7	1.6	58.7	70.4
Charitable institutions	18	5	3.9	1.2	27.0	65.3
Engravers and printers	28	126	.7	2.6	42.8	75.8
Garages (public)	47	5	2.5	3.2	121.6	118.5
Hospitals	24	6	6.1	2.8	45.0	104.1
Hotels over 7.5-kw	11	14	15.7	28.3	116.5	200.1
Hotels under 7.5-kw	53	160	1.8	1.6	95.0	137.7
Market booths	4	40	.5	1.1	57.5	132.2
Factories	290	319	2.9	2.9	32.6	66.5
Machine shops	16	15	1.1	1.1	30.8	48.8
Offices, business	179	257	1.7	1.5	48.3	72.4
Offices, professional	218	63	.7	.8	34.1	79.8
Offices, feed, coal, ice	96	5	1.0	1.5	57.2	108.6
Picture shows	95	39	7.2	11.7	60.2	119.9
Photographers	35	23	1.6	1.2	32.9	82.6
Restaurants	108	165	.7	1.5	181.0	244.6
Saloons	739	319	.8	1.2	140.9	193.2
Bakeries	143	19	1.6	1.4	87.5	142.5
Barbers	161	80	.5	.7	62.4	109.4
Tailors	105	68	.8	1.4	52.5	122.5
Cigar stores	32	62	.7	1.2	63.8	129.3
Clothing stores	30	62	2.2	7.3	56.5	131.2
Coffee stores	25	15	.8	1.0	53.4	94.9
Drug stores	319	53	1.0	1.9	126.3	209.2
Dry-goods stores	262	34	1.4	2.2	72.0	84.4
Florists' stores	41	12	1.0	1.2	56.6	97.9
Furniture stores	66	27	3.2	20.0	35.6	69.8
Grocery stores	405	44	.9	2.4	72.9	142.3
Jewelry stores	64	56	.8	2.8	69.8	124.8
Meat markets	230	13	.8	1.0	63.6	73.5
Shoe stores	143	56	.7	2.2	59.3	143.8
Theatres (season)	5	8	72.1	74.4	45.5	94.6
Warehouses	56	45	1.6	4.4	43.6	61.9
Wholesale houses	11	82	3.6	9.3	107.7	77.1

The task of securing this customer's account information with the tabulating machine, including compiling data for study of the company's income and comparison of its rates and costs with those obtaining in other cities, is being carried out by a special staff of clerks under the direction of Mr. C. E. Brenton, auditor of the Union Electric Light & Power Company, and is in charge of Mr. H. G. Kislingbury.

STREET ILLUMINATION DISCUSSION AT NEBRASKA CONVENTION.

Mr. C. M. Axford, of the General Electric Company, Kansas City, Mo., read a paper before the Nebraska Electrical Association convention at Lincoln in April which provoked a fruitful discussion on the subject of special street illumination. Mr. Axford first called attention to the reduced cost of operating electric signs with low-voltage tungsten lamps as compared with the former sign lamps. The possibilities of sign and outline lighting in small towns are thus much increased. He sugggested that when the main business street has considerable illumination of various kinds on it the company work to get outline or sign lighting on large buildings a little to one side of the regular business center and thus help create another center. By illumination at night it is possible to make one building stand out from its surroundings like a mansion amid a lot of small buildings in the daytime.

The movement for ornamental street lighting, he said, in a majority of cities has been taken up by the merchants with the co-operation of the city officials and the lighting company. The question of glare should be considered, and glare can be avoided by the use of diffusing glassware and proper placing of lamps. A handsomely lighted thoroughfare, Mr. Axford said, creates a good, lasting impression on visitors to a city. He then took up the possibility of confusing ornamental street lamps with sign and window lighting. To avoid this he suggested that all electric signs be placed high.

DISCUSSION.

Mr. R. E. Burger, general manager of the Fremont Gas & Electric Company, said that some central-station managers have opposed ornamental street lighting of this kind because it discourages electrical advertising in the shape of signs and window displays. The Commercial Club at Fremont had recently taken up the question of ornamental street lighting with the idea of having the municipal electric-light plant supply the energy. Agitation of this matter brought up an ordinance compelling companies to take all poles and wires off the street. For these two reasons he was not very enthusiastic about ornamental street lighting.

Mr. F. H. Brooks, of Lincoln, said that the plan of going around with a subscription list to get merchants to subscribe to a scheme for ornamental lighting meant non-uniformity and a failure to get a continuous line of posts down a street. He suggested that the best way of handling these matters in the future would be by means of a state law which would provide that if the majority of the property owners along a street petition the Council for special ornamental street lighting the whole street shall be assessed for the first cost of the installation. He said that such a law is in force in California, where much special lighting of this kind is done.

Mr. J. E. Schuff, of Lincoln, said that at Lincoln before the ornamental post lighting system was started the merchants had a prevalent idea that this lighting would do away with all necessity for window lighting. There were eight poles to the block with five lamps per post. The blocks are 300 ft. long from property line to property line. Now that the system had been tried in sections, all were satisfied that it would not light the windows.

Mr. J. R. Cravath, of Chicago, said that the general effect of an ornamental street-lighting system could not fail to make necessary increased lighting in the windows if any change at all were required. More light in the windows would be necessary to make the windows appear well lighted in contrast to the sidewalk, and there would certainly be no reduction in window lighting.

Mr. E. V. Capps recited his experience at Beatrice, where about 75 per cent of the merchants were in favor of ornamental post lighting, and a contract was practically assured when the proposition came up of taking all the wires off the street. This dampened his enthusiasm decidedly.

Mr. Joel Roberts, of York, thought that ornamental street lighting would increase the amount of window lighting.

Mr. C. C. Smith suggested that at Geneva, Neb., the plan had been adopted of putting brackets on the fronts of the business houses, instead of ornamental posts. Each bracket contains a 60-watt tungsten lamp. This was done through the efforts of the Commercial Club, which guaranteed the payment of the operating expense to the company. The wires are run along the fronts of the stores in a very inconspicuous manner, so that they would not be noticed unless one were looking for them.

Mr. L. J. Schwingel, of Holdrege, said that his company is making ornamental lamp-posts of cement. These posts carry three lamps and the cost of the cement post is about 75 per cent of that for an ornamental iron post of similar appearance.

Wiring and Illumination

2.5-WATT SIGN LAMPS IN ST. LOUIS.

About 2000 2.5-watt 2-cp tungsten sign lamps are now in use on various signs maintained by a local sign company in St. Louis. The first application of these lamps was made in the case of a small sign in which the 5-watt tungsten lamps produced objectionable glare, making it difficult to read the letters at a distance. The customer objected to this glare and as an experiment the smaller lamps were tried, with success. Although he was not aware of the progress of the experiment, which was one of the first practical trials of the small units to be made, the owner expressed himself as gratified that the difficulty had been corrected. The 2.5-watt lamps have since been used in several small and low-hanging displays. The performance of the 2.5-watt lamps in St. Louis has recorded practically the same life and renewals as those of the 5-watt units.

ORNAMENTAL LIGHTING SYSTEMS AT SPRINGFIELD, MO.

Springfield, Mo., a city of 36,000 population, has a variety of ornamental street-lighting systems in various parts of town, including tungsten curb posts, arches, brackets and flaming-arc lamps, affording the local officials an opportunity to compare the several schemes.

In one block eight flaming-arc lamps are suspended at 75-ft. distances over the center of the street. This installation cost 40 cents per curb-foot to erect, not including the poles, the regular line poles being used. The lamps cost 50 cents per curb-foot per year to operate.

Five blocks are equipped with a combined bracket and arc-lighting scheme, using incandescent units. On poles at 75-ft. intervals iron brackets extending 3 ft. from the poles, at a height of 10 ft., support downward-pointing 60-watt tungsten lamps inclosed in 10-in. frosted globes. There are seventy of these bracket lamps. Suspended across the street between the poles are fifteen-lamp stands of 8-cp lamps, the catenary hangers being arranged to form an arch of the lamps, 20 ft. high at the center. This construction is reported by Mr. N. J. Cunningham, secretary and treasurer of the Springfield Gas & Electric Company, to have cost 25 cents per curb-foot for wire, lamps and labor.

Along other blocks in the city curb post lighting is employed. The posts are set at 50-ft. intervals, 125 five-lamp posts being used at the corners and 250 three-lamp posts along the curbs in the blocks. These posts carry 1375 40-watt tungsten lamps inclosed in 10-in. alabaster globes, the top lamps pointing upward and the side lamps downward. The cables are run in lead sheaths. The construction of this special curb lighting cost $1.25 per curb foot. Records kept during 1910 show that the average lamp life was 720 hours and that approximately 12 per cent of the globes had to be replaced. The system is overhauled several times a year and the lamps and globes are replaced and thoroughly cleaned.

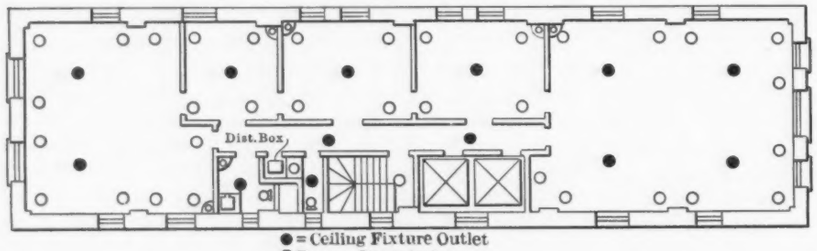
THE WIRING OF A MODERN OFFICE BUILDING.

By J. P. Morrissey.

Standing in its slender form among the monster buildings on the east side of Madison Square, New York City, is the Pullman Building at 17 Madison Avenue. It is 25 ft. wide, 100 ft. deep and sixteen stories high. In its circle it stands out prominently because of its size compared to the surrounding structures. It is a high-grade fireproof office building and has two fast passenger elevators, capable of lifting 2500 lb. at the rate of 400 ft. per minute and equipped to lift 6000 lb. at 100 ft. per minute. The elevator machines are of the electric traction type and are located on the roof. They were manufactured and installed by the A. B. See Electric Elevator Company.

The energy is taken from the mains of the New York Edison Company to a service board in the boiler-room, thence it is carried to the main switchboard and from there to the distribution boxes, to the outlets and to the motors. The service is divided by means of fuse posts and busbars on the service board, and from this board motor and lamp feeders are run to the main switchboard. These feeders are run in conduit exposed on the basement ceiling. The division of lamps and motor circuits at this point eliminates the possibility of the starting of motors from affecting the light due to the heavy starting loads on the motor feeders.

The switchboard is situated in a room just in the rear of the boilers. This room has been set aside for the switchboard, house pump and section tank and is just large enough to accommodate them. From the switchboard a three-wire lamp feeder is run to a center of distribution on the eighth floor, where it splits into two sections, one going up to the sixteenth floor, looping through the office lighting section in each panel on each and every floor from the eighth floor up, and the other section going down to the second floor, looping through the office-lighting section on each panel on each floor from the seventh floor down.



Arrangement of Lighting Outlets.

Another three-wire feeder runs from the switchboard to the riser shaft, thence up to a center of distribution and feeds in the same manner described for the office lamps. This feeder is for the lamps in the public halls and toilets from the second floor to the roof inclusive. A three-wire feeder is run from the switchboard to a distribution box in the store on the first floor for the lamps in the store and basement.

A three-wire feeder is run from the switchboard up to a switch on the stair landing on the eighth floor for the stair lamps, where it divides; one outside leg with a neutral tap is run up to the roof, inclusive, connecting to a lock switch at each floor landing. The other outside leg with a neutral tap runs down to the second floor, inclusive, connecting to a lock switch at each floor landing. These lock switches control lamp-receptacle outlets on each stair landing. A motor feeder is run from the switchboard up the riser shaft to a motor panel on the roof. From this panel the sub-feeders are run to the elevator machine-control boards and the motor generators for the signal system.

The branch circuits for owners' lamps in the basement and first-floor halls are run from the switchboard to the outlets and respective switches. In the basement a motor feeder is run to the switch for the house pump.

From the switchboard a two-wire branch is run to a lock switch in the first-floor entrance hall and from there it runs up to an outlet at the ninth floor in the elevator shaft to which are connected the traveling cables for supplying energy to lamps in the elevator cars.

The service board is located at an accessible point in the boiler-room. The board is made of slate and has mounted upon it a three-pole service switch, proper busbars and fuse posts to divide the service as hereinbefore mentioned for lamps and motors. The board is inclosed in a hard-wood cabinet properly lined.

The space in the room in which the switchboard is located is limited, but the switchboard was designed for the location. The board is made of panels of 1½-in. polished marbleized slate mounted on an angle-iron frame which is embedded in the floor and braced against the wall. Mounted on the face of the board are switches and fuses for controlling the energy in each feeder and branch circuit. Switches are also provided for further use for both lamps and motors. All switches and meter connections are finished in polished copper. Provision has been made for back-connected meters and all energy is metered on the switchboard. Each switch and meter has an engraved polished copper nameplate. The switches are three-pole for lamp and two-pole for motor circuits and are so connected that the fuses are dead when the switches are open. The arrangement of the rear of the board is very unique. No wiring is done on the rear of the board. The service feeders are connected to lugs that are attached to their respective busbars and these are run to the meters and switches. The busbar work is all done near the back of the slate panels. From the switch lugs to a point at the top of the rear of the board rolled-copper rods are run from each section of each switch. At the top ends of these rods connectors are used so that the feeder cables and branches may be connected to these rods. These rods are covered for their entire length with circular loom and they are held in place by a perforated slate slab at the top of the board. This rod arrangement is found to be very good, because in case of rearrangement of busbars or changes they can readily be removed and replaced. Above the switchboard a pull box has been installed. This is made of sheet iron and painted. The feeders and branch circuit conduits come into the sides and top of this box. All the crossing of cables and wire has been done in this box and the front half of the bottom section has been drilled so that the feeder cables and wires come down to their respective lugs in a vertical position. The rear bottom half and the front sections are removable so as to give access to the inside of the box. The bottom of this box is only 1 ft. above the top of the connections, so the cables and wires are covered with circular loom from the bottom of the box to the top of the connectors on the top of the rods. From the pull box conduits are run for the feeders and branch circuits, as hereinbefore described.

The conduit used in this installation is the black-enameled

loricated kind called "Richmond." The branch circuit conduit is run from the distribution boxes to the local switches, thence to the ceiling outlet boxes and from distribution boxes to ceiling receptacle outlet boxes, looping through until the arrangement that has been designed has been connected.

The fixture hangers used are what are called "McKnight" hangers. These are made up of two bands of iron 1 in. x 3/16 in. and 12 in. to 16 in. long. The bands are riveted to a threaded ½-in. nipple that is slotted at the top end to admit the bands where they are riveted.

To locate properly the electric lamp outlets and their controlling switches to suit the different arrangements of office furniture and partitions is a difficult problem. No two business interests have the same office arrangement. Of course, new outlets could be located after the furniture has been placed in position, but the work is most unsightly and unsatisfactory, because it would have to be done exposed. A very simple arrangement of outlets has been thought out for the offices. The architect had made his plans with the arrangement of office and other possible arrangement of partitions to suit the tenants. In each office a ceiling outlet was placed for a fixture and this was controlled by a local switch located on the outside wall. The locating of the switches on these outside walls kept all conduits out of partitions, thereby lessening the expense of any changes in the removal of partitions.

Properly located according to all arrangement of partitions are ceiling receptacles. These are installed so the brass faceplate comes flush with the finished plaster. From these receptacles drop cords and special fixtures with screw attachment plugs can be installed. They are so located that it is practically impossible to locate office equipment and have no provision for lamp extensions.

In the boiler-room, coalroom, pumproom and other machinery rooms in the basement and on the roof ceiling receptacles have been installed. In each receptacle a drop cord has been provided made up of a screw attachment plug, 8 ft. of reinforced cord and an "Edison" lamp key socket.

The local switches that are used throughout the building are of the "Metropolitan" detachable pattern. In the offices and toilet-rooms they are of the push type and on the stairs and in the entrance hall they are of the lock type.

There is a public hall on each floor and the lighting outlets are controlled individually from the panel board on the floor. The panel boards are located in the porter's closet on each floor. These panels are installed in a distribution box made of sheet iron thoroughly painted before they were installed. The boxes are made so that when the panels are installed there is a 3-in. gutter on both sides, top and bottom, in which are run the feeder cables and branch circuit wires. The panels are made of 1-in. polished marbleized slate.

Each panel has two sections, one for circuits for the offices and one for circuits for public halls and toilets. The busbars are arranged on the panel so that the feeders connect to lugs at each end, thereby feeding through. The branch circuits are controlled by knife switches connected to the busbars on both sides. The switches are so arranged that the fuses are dead when the switches are open. A fireproofed wood trim and door has been installed on each distribution box, the trim covering the gutter space and the door opening so as to expose only the panel board. On each door a small directory has been placed inside of a copper-finished frame with a plate glass covering it. The directory is made up in the shape of a plan on a small scale and has the outlets located on it and the number of the switch controlling the outlet is marked at the outlet location on the plan.

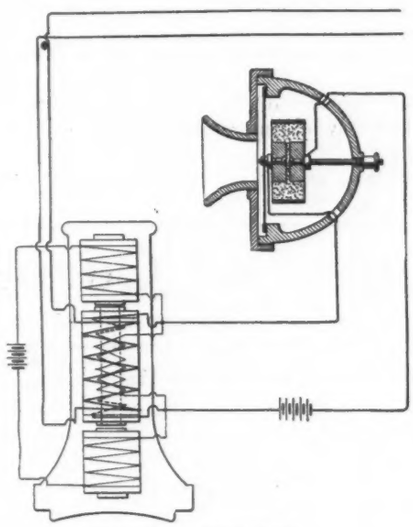
The wire used throughout the building is "Habershaw Redcore." All feeders are designed so that the loss will not be greater than 3 per cent between the switchboard and any lamp at full load.

A house pump has been installed to pump water to the tank on the roof from the tank in the basement. This pump is automatically operated by tank switches, one in the basement tank and the other in the tank on the roof. The tank switches are so arranged that the pump will not work unless the basement tank is nearly full and the roof tank half full. These tank switches work in series so that the pump cannot operate if there is not enough water in the basement tank or there is enough water in the roof tank. The building was designed and the construction supervised by Mr. William H. Gompert, architect; Pattison Brothers were the consulting engineers; Chas. A. Cowen & Company were the builders, and the Porsth Electric Company were the electrical contractors.

RECENT TELEPHONE PATENTS.

ELECTROMAGNETIC RECEIVER.

As usually conceived the electromagnetic receiver merely omits the usual polarizing permanent magnet, having instead a polarizing winding. The receiver brought out by Mr. W. C. Lockwood, of San Juan, Porto Rico, is of more elaborate design, as it includes in addition the induction coil. The accompanying cut shows the arrangement. The usual receiver diaphragm, not shown in the cut, is placed behind the earpiece



Lockwood Telephone.

in the field of the magnet. It will be seen that the transmitter is included in the circuit of both batteries, directly in one and as a shunt of the other. The middle winding is the induction-coil primary, the end windings are polarizing coils, while the heavy line shows the induction-coil secondary.

REPEATER.

There have been a number of plans for using a high-frequency generator as relay or repeater for telephone circuits. The generator is of the inductor type. Two windings are provided, each in inductive relation to the inductor but not in inductive relation to each other save through the inductor. One set of windings is connected to each line section. If the inductor is revolved and telephone waves be impressed upon one winding the currents set up in the inductor will in turn cause a new and stronger current to be set up in the second winding.

SWITCHBOARD CIRCUIT SYSTEM.

In a patent granted to Mr. A. H. Dyson, of Chicago, is described a circuit system for common-battery switchboards. One relay serves to control both line and supervisory lamps. This relay serves as part of the battery-feed circuit. The line-lamp circuit is closed through the front contact of the relay. The lamp is of lower voltage than the battery so that a controlling resistance is included in the circuit. When a plug is inserted in an answering jack the supervisory lamp is put in parallel with the line lamp, both in circuit with the controlling resistance. Under this condition neither lamp receives sufficient current to

glow. When the relay falls back the line lamp is left on open circuit and the control resistance is partially shunted out through a relay back contact. This patent is assigned to the Western Electric Company.

Letter to the Editor.

The Introduction of "Deceleration."

To the Editor of Electrical World:

Sir:—For some time past a controversy has been in progress in the *Proceedings* of the American Institute of Electrical Engineers concerning the propriety of the verb "decelerate" and its attendant noun "deceleration." As sponsor for these words we find no less a person than Dr. Steinmetz, while the chief opponent of their use is Mr. C. O. Mailloux. In the *Proceedings* for March, 1911, Dr. Steinmetz sums up his argument in the form of a syllogism:

"1. It is permissible to add to a living language by the formation of new terms if these terms are needed and are correctly formed.

"2. The verb 'decelerate' is needed, and with it the noun 'deceleration.'

"3. It is derived correctly in accordance with the usage of the Latin language."

In the April number of the *Proceedings* is Mr. Mailloux's rejoiner, which may be summarized as follows:

1. Admitted.

2. Denied, since "retard" and "retardation" are adequate for all the purposes to which the new words might be applied.

3. Denied, both on philological and on literary grounds.

Though making no pretense of being a Latinist, it is in connection with this second minor premise of Dr. Steinmetz's that I beg the privilege of saying a few words. Dr. Steinmetz seems to find an analogy between "scando," "ascendo," "descendo" and "celero," accelero," "decelero." As Mr. Mailloux points out, this last word does not exist in Latin. The prefixes "ad" and "de" when applied to "scando" are prepositional in their character and add a directional idea to the main idea of the verb, but "ad" applied to "celero" is merely intensive and adds no new idea. Hence we do not find, and should not expect to find, "decelero." Dr. Steinmetz's analogy is not only incomplete, but it is absolutely misleading.

Of course, there is nothing to prevent scientists from coining and using words which violate the fundamental principles of philology, but it seems to me that the question is a more fundamental one than that of mere expediency. Our scientific and professional nomenclatures are in a sufficiently confused state as it is, and the introduction of such words as these, which I believe to be absolutely incorrect, but concerning whose legitimacy there is, at least, a reasonable doubt, does not tend to clarify matters. The establishment of a unity of convention among the various sciences would be a step toward the unification of all knowledge to which every thoughtful man must look as to an ultimate good, and the deliberate adoption of technical terms which have not the most complete philological justification postpones rather than promotes the attainment of such unity.

Brooklyn, N. Y. William J. Berry.

Digest of Current Electrical Literature

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Self-Exciting Three-Phase Commutator Generators.—R. Ruedenberg.—The author discusses the behavior of a self-exciting three-phase commutator generator when carrying a purely inductive load. The arrangement is shown in Fig. 1. The stator and rotor circuits, which are indicated by the indices 1 and 2 respectively, are connected with each other through an external regulating transformer which permits one to vary at will the amplitude and phase of the secondary voltage. When the machine is not loaded the adjustment of the regulating transformer determines the frequency of the current and the voltage. The generator may then be connected to an inductance coil 3,

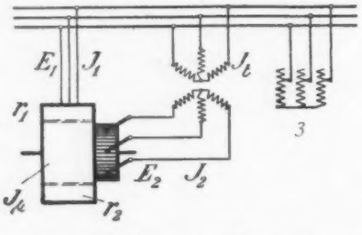


Fig. 1—Connections of Self-Exciting Three-Phase Commutator Generator.

which takes wattless current from the generator. By adjusting the inductance coil, the wattless currents supplied by the generator can be varied. With the aid of diagrams the author gives the formulas which determine the behavior of the machine when the external inductance coil is adjusted. He shows especially that this method affords a simple means of reducing the synchronous voltage of the generator to much smaller values than is possible by regulating the self-excitation alone. Tests with such a generator showed that simply by connecting it with a properly dimensioned induction coil the synchronous voltage could be reduced below 5 per cent of its normal value without impairing the stability of running. When the induction coil was disconnected the voltage rose again to its former value. If in the operation of commutator generators it is desired to get simultaneously a variation of voltage and a variation of frequency, it is possible to do this with the same regulating transformer, in which the iron saturation must then be sufficiently high. If, for instance, the rotor and stator are connected in series (Fig. 2) so that the synchronous voltage is impressed on the network, the regulating transformer can be connected between network and stator as indicated. By varying its transformation ratio, with respect both to value

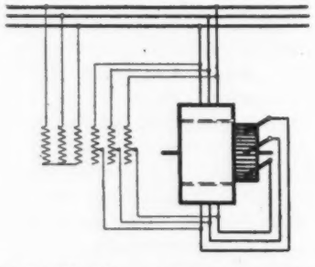


Fig. 2—Modification of Connections of Fig. 1.

and phase, the frequency of the generated three-phase currents is regulated. If the transformation ratio is varied in such a way that the number of turns connected to the stator is reduced, the voltage of the network also decreases. The voltage decreases about in the same proportion as the frequency; with the connections of Fig. 2 the frequency is proportional to the number of transformer turns connected to the stator. Such a generator would, therefore, be suitable for the operation of induction motors at variable speed. The author remarks that the same method of reducing the self-exciting voltage can also be used for direct-current machines, for instance for operation

of the Ward Leonard drive. Of course, the induction coil with saturated iron must be connected to such a circuit from which a magnetizing current can be taken, which is not directly possible with pure direct current. But if the direct-current generator is equipped with slip rings, as shown in Fig. 3, and the adjustable induction coil is connected to these, the direct-current voltage can be reduced at will. The author finally shows how it is possible to regulate the frequency of a self-

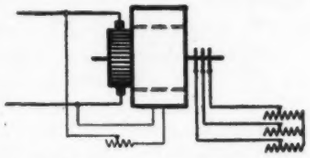


Fig. 3—Method of Reducing the Voltage of Direct-Current Machines.

exciting three-phase commutator generator while maintaining the synchronous emf and the field constant.—*Elek. u. Masch.* (Vienna), April 9.

Mercury-Vapor Rectifier.—An illustrated description of a new mercury-vapor rectifier by Hartmann and Braun for high outputs. The methods by which an increase in output has become possible are described, especially the means of maintaining the vacuum, and some data are given on a converter consisting of two mercury-vapor lamps which furnished a rectified secondary current of 300 amp at 230 volts.—*L'Industrie Elec.*, March 25.

Magnetization Curve.—F. RUSCH.—A mathematical paper in which the author describes a simple method and illustrates it with a numerical example for determining the magnetization curve, giving E as a function of the magnetizing current, for the case that the magnetizing winding is distributed in various slots per pole.—*Elek. Zeit.*, March 30.

Circular Diagram of Induction Motor.—R. SILBERBERG.—The author describes a simple method which permits one to plot in a few minutes the exact and complete Ossanna circular diagram of the induction motor.—*Elek. Zeit.*, March 30.

Lamps and Lighting.

Efficiency of Metallic-Filament Lamps.—R. A. HOUSTOUN.—A paper read before the Royal Society of Edinburgh. If Q = total electrical energy consumed per second, R the total energy radiated per second and L the total luminous energy radiated per second, then he makes the following definitions: L/Q = luminous efficiency; L/R = radiant efficiency of the lamp. For the purpose of defining L, it is usual to take 760 $\mu\mu$ as the upper limit of the visible spectrum. The lower limit is immaterial, as there is little energy in the violet and ultra-violet spectrum of glow-lamps. The luminous efficiency does not measure the commercial value of a lamp, because the eye is very much more sensitive to green than to red light; for example, it is possible for one lamp to have much more energy in its spectrum than a second one, but yet to have that energy so disadvantageously distributed that the second produces a stronger effect on the eye. For determining the radiation efficiency the author employs the following method: The radiation was first measured in the usual way by a thermopile and galvanometer with and without a 1-cm thick water filter, and the percentage of total radiation transmitted through the filter was determined. In this case the radiation from the whole lamp was received by the thermopile. A straight part of the filament of average brightness was then focused by an achromatic glass lens on the slit of a spectrometer with glass prism which was furnished with a Rubens linear thermopile in place of the cross-wires. The same water filter was placed in front of the slit and an energy curve of the filament was taken through the filter. For the region of the spectrum for which water transmits the absorption of light in the glass and the loss of light by reflection at the glass surfaces may be taken as independent of the color. If the prismatic energy curve thus determined be taken and an ordinate set up at the point 760 $\mu\mu$, the area on the side of shorter wave-lengths divided by the whole area gives the fraction of the radiation transmitted by the filter, which is light. It is only necessary now to find what fraction of the incident light is transmitted by the water cell. This was done by measuring the transmission coefficient of the latter when filled with water with a spectrophotometer for four different points in the spectrum. The value found was 0.84. It is somewhat low, as the glass sides of the cell absorbed rather more than usual; it did not vary with the color. The following table shows some of the results obtained:

RADIANT EFFICIENCIES IN PER CENT.

Volts.	250-Volt Carbon.	250-Volt Carbon.	250-Volt Tungsten.	250-Volt Tungsten.
184	1.40	0.72	4.96	5.98
216	1.97	1.48	7.42	9.02
250	3.42	2.42	7.60	9.39
270	3.95	3.43	8.06	9.59

Volts.	130-Volt Tungsten.	130-Volt Tungsten	125-Volt Tantalum.	125-Volt Tantalum.
75	1.61	1.69	2.06	3.00
125	6.61	6.43	6.66	6.35
146.5	9.04	8.83	.....	.....
150	.....	.....	7.70	9.25

A 50-volt osmium lamp which was also tested gave a percentage efficiency of 2.17 at 30 volts, 3.84 at 45 volts, and 6.52 at 55 volts.—Lond. *Electrician*, April 28.

Exhausting Lamp Bulbs.—A note on a recent British patent (10,870, April 20, 1911) of F. Harrison. In order to exhaust completely the bulbs of incandescent lamps, and particularly those for emfs below 30 volts, red phosphorus or arsenic is inserted in the bulb or on the stem, and the bulb is first exhausted by a pump in the usual way. It is then placed in the electrostatic field or between the terminals of an induction coil or high-tension transformer, so that a bluish glow appears. At the same time a current greater than the normal is passed through the filament, and the phosphorus is heated by a flame until the blue glow disappears, whereupon the lamp is sealed off.—Lond. *Elec. Eng'ing*, April 27.

Generation, Transmission and Distribution.

Battery Economics.—A. M. TAYLOR.—A paper read before the (Britsh) Institution of Electrical Engineers. The author first deals with the effect of rapid-discharge rates on the amp-hour output and terminal emfs of batteries. The method of discharging large batteries by means of regulating cells has been employed on a considerable scale both in America and in Continental Europe, whereas in Great Britain the tendency has rather been to employ boosters for the discharge. The method employing regulating cells is very simple and reliable, yet it has many disadvantages, especially for rapid rates of discharge, in view of the large number of regulating cells required, the high cost of the regulating switches and the difficulty of maintaining the cells in a healthy condition, as some of them are hardly ever called upon to give a discharge. The author offers suggestions for materially diminishing the cost and inefficiency of booster methods. With a view to emphasizing the extent to which the cost of the boosters may be reduced by a suitable arrangement of boosters and batteries, the author gives, in some detail, an investigation into a particular case in which it is desired to deliver an effective discharge on to the busbars of 2530 kw (at 510 volts) for one hour, or 5140 kw for a quarter of an hour, or 6370 kw for five minutes. Three different methods of obtaining this result are by a battery with regulating cells,

by the ordinary booster arrangement of Fig. 4, and the triple series arrangement shown in Fig. 5. The waste of battery amp-hours with the ordinary booster arrangement is very considerable, and in the case of the one-hour rating the author shows that the output of the booster by the third arrangement

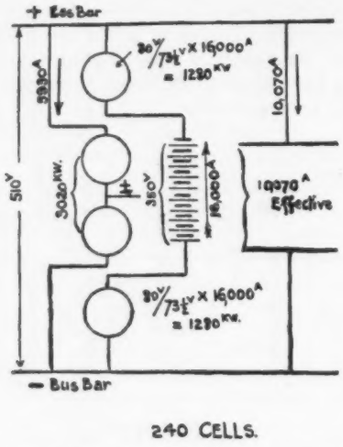


Fig. 4—Diagram of Connections for Ordinary Booster Arrangement.

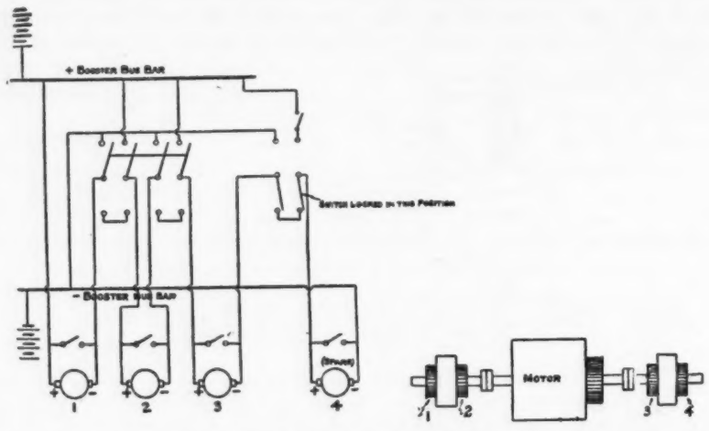


Fig. 6—Diagram of Connections for Triple-Series Arrangement of Boosters.

is reduced by nearly 500 kw-hours. Detailed figures are given for the three systems showing the total cost per effective kilowatt to be $34.30 for the system of regulating cells, $35.70 for the ordinary system of booster with ordinary balancer and $30.50 for the system of triple series parallel booster with static balancer. These figures are for one-hour discharges. The corresponding figures for one-fourth-hour discharges are $20.90, $24.40 and $19.20 respectively, and for five-minute discharges $15.20, $23.55 and $18.70 respectively. In Fig. 6 is shown a diagram of connections for obtaining the "triple series" arrangement of boosters. As shown in the right-hand bottom corner of this diagram, a motor can be employed to drive two double-wound booster armatures, each having two commutators, giving four booster armature windings, which can be coupled in series or parallel; the fourth winding, however, would be used as a reserve. A preferable arrangement, where cost is not a prime consideration, would be to have two separate motors and four single-wound armatures, each under its own field. The author also describes another booster arrangement for a special case and then discusses the increasing use in the United States of batteries as a standby. The author suggests that where batteries are put in on a large scale for lighting purposes it will generally be found preferable to put in those batteries which deal with what may be called "time" peak

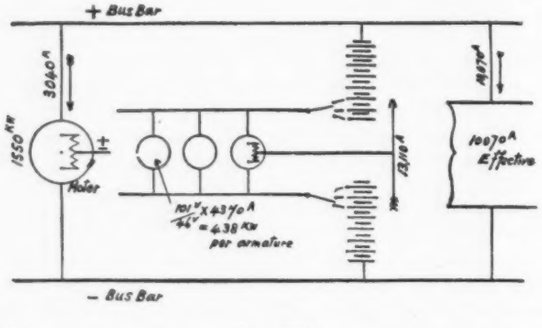


Fig. 5—Diagram of Connections for Triple-Series Arrangement of Boosters.

(as distinct from "instantaneous" peaks), arranged to be operated by hand-regulated boosters; but, since the voltage of a battery alters very considerably with its rate of discharge, it would also seem desirable to have a smaller battery, which might be of the nature of a buffer battery, to take up the "instantaneous" peaks by means of an automatic booster, and so keep the busbar pressure constant, while the main battery would be regulated by hand in such a manner as to enable boilers and engines to be shut down to the maximum possible extent. Finally, the use of storage batteries with alternating current is discussed, and the author offers the following proposals for improving the power-factor in a pure (or mixed) alternating-current system. Referring to Fig. 7, the rotary converter or motor-generator *A* and its battery *C* are used for taking up the peaks of the load in a manner well understood. The second rotary converter, motor-converter or motor-generator *B* is a synchronous machine operated as motor, fed from the alternating-current line and drawing therefrom a leading wattless current sufficient in value to compensate for the lagging wattless currents taken by the consumers' motors. The special feature of the author's proposal is that the rotary converter *B* is enabled to find a useful load for itself by charging the battery *D*, and thus a given kilovolt-ampere motor load can be handled with a much smaller expenditure in synchronous machines than would otherwise be the case. When the evening peak load comes on the charge in the battery *D* is available in assisting the rotary converter *A* to deal with the load; and the motor-generator *B* may be either used to perform phase-changing by itself, or, if not needed for that, is available to assist the motor-generator *A* in dealing with the peak. With respect to H. G. Stott's recent suggestion to provide the extra power by adding exhaust turbines rather than batteries, the author thinks that the turbine scheme has various disadvantages. First, the standby coal required to keep the boilers going through the night will still be required as before. Moreover, the steam units cannot be so economically loaded up at all times of the day and night as by the use of batteries. Another point apparently overlooked is that the scheme introduces the extra equipment at the wrong point; it should be preferably

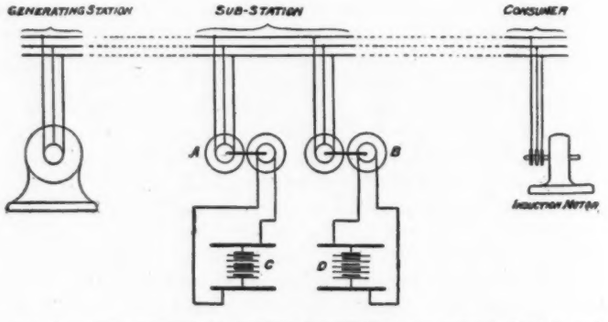


Fig. 7—Arrangement of Rotary Converters for Power-Factor and Load Compensation.

introduced at the substation. The author thinks that for peaks of short duration, say up to two hours, the batteries will be found decidedly the cheaper, and, moreover, a smaller additional staff will be required than with the turbo scheme. The question of power-factor, which must also be considered, is a further inducement toward the use of batteries.—Lond. *Electrician*, April 28.

Swedish Water-Power Plant.—An illustrated description of the Trollhättan power scheme, which makes use of the Trollhättan Falls of the river Göta, which flows from the lake Venern to the sea. The total difference of levels between Lake Venern and the sea is about 144 ft., of which about 105 ft. is actually in the Trollhättan series of falls, and the minimum flow of the river is over 4,000,000 gal. per minute, rising to a maximum value of about 12,000,000 gal. per minute. The enormous storage of Lake Venern, which has a surface of no less than 2150 square miles, can, however, be utilized, so that the total power which could actually be relied upon all the year round reaches the total of 200,000 hp. The water-power rights for the whole river are owned by the state, which commenced in 1906 the construction of a station capable of dealing with some 3,300,000 gal. per minute, corresponding to about 80,000 hp at the turbines. The turbines in the power station are of the horizontal-shaft pattern directly coupled to the generators. The main turbines will be eight in number, each rating at a normal output of 10,000 hp at 187.5 r.p.m., with a net head of 103 ft., but each is capable of developing a maximum output of 12,500 hp. The generators are wound for an emf of from 10,000 volts to 11,000 volts, three-phase, 25 cycles, and a continuous load of 11,000 kva each. They are completely inclosed and are ventilated by air being drawn through the cases from ducts coming under the machine-room floor by fans carried on the rotors. The heated air is expelled into the open air in summer, but can be used in winter for the warming of the various buildings. There are two 350-kw exciting generators, which supply continuous current at from 220 volts to 300 volts. They work in conjunction with a 4000-amp-hour battery. The excitation of the main generators is not controlled, as is usually the case, by series rheostats, but by means of boosters directly coupled to each set which can procure any emf from 110 volts to 220 volts, so that by opposing or aiding the pressure of the continuous-current bars any voltage from 0 to 300 may be applied to the field circuits of the generators. For transmission emfs of either 10,000 volts or 50,000 volts are used.—Lond. *Elec. Eng'ing*, April 20.

Electricity on the Northeast Coast of England.—The third article of this very long and fully illustrated series. In the present instalment the cables and pole lines are discussed. The energy is mainly transmitted by the 20,000-volt trunk system which is now connected to all the principal stations, and at these different feeding points on the system the emf is transformed down for distribution by subsidiary networks. The greater part of the 20,000-volt network is laid underground, paper-insulated, lead-covered cables being employed. There is much overhead distribution in connection with the new mains, but in only two cases are 20,000-volt lines so carried. While the interconnection of the many generating stations and substations affords great security against total failure of supply, it also requires special care to prevent the effects of breakdown in one place from spreading to the rest of the system. The Merz-Price balanced protective gear is employed with great success. The system is based upon the principle that, while normally the amount of current leaving a conductor at one end is equal to that which enters it at the other, as soon as a fault or leak develops this equality disappears. By inserting series transformers at both ends of each core of the cables, and connecting their secondaries in opposition by means of pilot wires with relays in circuit, it is made possible to trip the switches at both ends of the cable when, due to a fault, the balance between the two sets of series transformers is upset and, in consequence, a current flows through the pilot wire. In this way, as a fault affects only the particular pair of series transformers on either side and immediately adjacent to it, causing a current to flow along the pilot wire connecting these transformers, the faulty section is isolated without disturbing any other.—Lond. *Eng'ing*, April 21.

Steam Turbine.—An illustrated description of the impulse steam turbine of the Rateau type built by the British Westinghouse Company.—Lond. *Elec. Eng'ing*, April 20.

Traction.

Speed Indicators for Tramcars.—An abstract of a report of a special committee of the British Tramways and Light Railways Association. The chief conclusions are as follows: There are now on the market speed indicators which, as far as the instruments themselves are concerned, have worked satisfactorily during the tests, although it is not at present possible to state what their life is likely to be when fixed on tramcars. Transmission gears could be made which might withstand for some time the rough conditions met with underneath a tramcar; their first cost and maintenance, however, must be considerable. In view of the first cost and the cost of maintenance of instruments and transmission gear, it would be a serious burden on tramway undertakings to have to equip service cars with indicators. As the proper maintenance of the existing equipment on a car already fully occupies the attention of the staff during the short time available between cars leaving and returning to their sheds, it is most undesirable to add anything more to a car which will require attention, especially if this is not a vital part of the equipment. The electrical form of speed indicator is the cheapest and easiest to fit, but indicators of this type appear unable to withstand the rough conditions of tramway operation. If speed indicators are required at all, they should be fitted only on cars for instruction and test purposes. Except for special test purposes, no speed-recording chart is necessary, and a mileage recorder is not required. No indicator showing the maximum speed attained (by ringing a bell or moving a maximum pointer) is of much value, as the authorized speed varies at different parts of the same route; and, whereas it may be safe to exceed an authorized speed of, say, 16 miles per hour on one part of a route, it may be dangerous on another part of the same route to exceed even 4 miles per hour. Since the most successful form of transmission gear is that in which a belt or chain is driven from one of the car axles, the wear of the wheel will necessitate a constant adjustment of the instrument, otherwise there would be a considerable inaccuracy in the reading of the indicator.—Lond. *Elec. Eng'ing*, April 20.

Single-Phase Supply for Traction in London.—G. W. PARTRIDGE.—The first part of an illustrated description of the present installation at the Deptford generating station in London for supplying single-phase energy to the South London line of the Brighton Railway. Specially designed three-phase generators are used, arranged so that they can be employed either for the single-phase supply to the line or for three-phase supply for general distribution. The pressure is kept absolutely constant by means of a Tirrill regulator, in spite of rapid variations in load from 3000 kw to zero, and a simple but effective arrangement of duplicate feeders prevents unnecessary interruptions of supply from momentary short-circuits. Notes on the switchboard, the railway feeders, busbars and the isolating switches are also given.—Lond. *Elec. Eng'ing*, April 27.

Railless Traction.—An illustrated translation of the recent German paper on the railless electric traction system in use in Bremen, Germany.—Lond. *Electrician*, April 28.

Steering Gear.—H. S. HELE-SHAW and F. L. MARTINEAU.—A paper describing a new form of electrically driven steering gear with a new form of hydraulic transmission.—Lond. *Elec. Eng'ing*, April 20.

Installations, Systems and Appliances.

German Electrical Industries in 1910.—W. FELLENBERG.—A long article giving a great many statistical data on the German electrical industries in 1910. In Greater Berlin the number of

workingmen was 29,000 more in 1910 than in 1909, and at least one-half of this increase in workingmen was in the electrical industries. One of the large German electrical firms employs at present 70 per cent men and 30 per cent women. Among the men there are 50 per cent skilled, 30 per cent have gone through an apprenticeship in the works and 20 per cent are unskilled. For the last two classes there is sufficient labor supply in Germany, but it becomes more difficult from year to year to get skilled mechanics and toolmakers. Data are given of the copper, iron, lead, zinc, tin, rubber and platinum markets. Large tables are given of the imports and exports of electrical products. The following figures give an idea of the development of electrical central stations in Germany:

Year.	Number of Stations.	Rating in Million Kilowatts.	Connections in Million Kilowatts.
1907	1530	0.860	1.100
1909	1978	1.160	1.880
1910	2260	1.380	2.140
1911	2800	1.550	2.560

Characteristic features of the development of central stations in Germany are the increase of the number of municipal stations and the increase of the number of stations which buy electricity in bulk from other larger stations.—*Elek. Zeit.*, April 6 and 13.

Gas Plants and Electricity Stations.—F. Ross.—An article giving statistical data on the increase of the use of gas and electricity in German cities. First, cities with more than 100,000 inhabitants are considered. The increase of production of gas per capita during the last six years was 15.7 per cent, but the statistical data of the author show that this increase of gas production has not been due to an increased use of gas for lighting or for gas engines. On the other hand, the number of kw-hours sold per capita by central stations in cities above 100,000 inhabitants has increased during the last six years 136 per cent, the electric-light connections 68 per cent, and the electric-motor connections 119 per cent. The increased demand for light has, therefore, been covered entirely by electric light. Further, where the electric motor is in the field the small gas engine is no longer used. The author shows that the situation is the same in German cities with from 50,000 to 100,000 inhabitants.—*Elek. Zeit.*, April 27.

Electric Installation of a Club.—A fully illustrated description of the electrical equipment of the new building of the Royal Automobile Club, Pall Mall, London. The supply is at a pressure of 110 volts direct current for lighting and 220 volts for motor service. There are fifty-two general lighting circuits controlled from the switchboard. Each of these circuits is designed for 100 amp; twelve of them supply energy to the basement and are metered separately, being charged at a special rate. There are also twelve motor circuits supplied with energy at 220 volts for working elevators and fans, and two 110-volt circuits, one for supplying energy to the cinematograph in the lecture theater and the other for supplying energy to apparatus in the photograph room. From the sub-boards the wires are run in steel-screwed conduit placed under the floors.—Lond. *Electrician*, April 28.

Wires, Wiring and Conduits.

Hard Copper Wire.—A note on a recent British patent (7657, April 20) of the Elektrochemische Werke Ges. (Berlin). Up to 1 per cent of calcium or molybdenum or smaller percentages of each are added to electrolytic copper instead of aluminum and magnesium, as is now usual, to produce hard wires for overhead lines. Whereas a usual requirement for such wire is a conductivity of 95 per cent with a tensile strength of 40 kg to 46 kg per square millimeter, a wire with 0.35 per cent of calcium is stated to give on test 98 per cent conductivity and a tensile strength of 54 kg per square millimeter. Similarly, a wire with 0.05 per cent of molybdenum is stated to give 96.2 per cent conductivity and a tensile strength of 52.9 kg per square millimeter. By adding 0.35 per cent of both calcium and molybdenum to pure copper, a conductivity of 98 per cent and a tensile strength of 52 kg per square millimeter are said to be obtained.—Lond. *Elec. Eng'ng*, April 27.

Elasticity of Long Wires at Varying Temperatures.—In an account of last year's work at the (Brit.) National Physical Laboratory mention is made of a research undertaken for the British Post Office, the India Office and the National Telephone Company. It concerns copper and bronze wires from 0.194 in. down to 0.049 in. in diameter, stretched in a galvanized water trough 50 ft. in length. The modulus of elasticity and the linear expansion coefficient have been determined both on the 50-ft. length and on short specimens of 6 in. within the temperature range -12 to $+60°$ C. In the case of copper wire of 0.158 in. the modulus is 13×10^6 lb. per square inch measured on the whole length, and 17.7×10^6 lb. on the short specimen. In thinner wires the discrepancy is less marked. The discrepancy seems to be due to kinks, and was noticed in wires only when under the first loading. The wire was uncoiled by fixing the free end to the floor and rolling the coil for 50 ft., one hand always gripping the wire to prevent it slipping out. It was found almost impossible, however, to prevent the formation of some kinks. When the material was slightly overstrained on the first loading to take out the kinks the discrepancy vanished.—Lond. *Eng'ing*, March 24.

Wiring.—P. H. Perls.—A review sketching the evolution of the use of different materials in wiring installation, with special reference to the effect which the regulations of the German Association of Electrical Engineers have had on this evolution.—*Elek. Zeit.*, April 13.

Electrophysics and Magnetism.

The Propagation of Magnetic Waves in an Iron Bar.—C. V. Drysdale.—An article illustrated by diagrams in which the author points out that there is a close analogy between the propagation of alternating magnetism along an iron bar and that of alternating current along a cable. Experimental results are given confirming this analogy, the measurements being made with a search coil and the author's alternating-current potentiometer.—Lond. *Electrician*, April 28.

Impedance Paradox.—J. Herzog.—A paper with reference to the article of F. M. Denton in *Electrical World*, Vol. 56, 1910, No. 6. The author discusses the problem with the aid of vector diagrams and explains the paradox.—*Bull. d. Schweiz. Ver.*, Vol. 2, 1911, page 1; abstracted in *Elek. Zeit.*, April 13.

Units, Measurements and Instruments.

National Physical Laboratory.—A very full account of last year's report of the (Brit.) National Physical Laboratory. Those researches dealing specifically with electrical subjects have been or will be abstracted separately in the Digest. The first instalment deals with the engineering department, researches of wind pressure, friction of air in pipes, welded joints, alternating stress at high frequency, abrasion, elasticity of long wires at varying temperatures, shock tests of screw-threads, tests of high-pressure gages, stream lines, aeronautics, air-swirl in the neighborhood of the whirling arm, balloon fabrics and tank department.—Lond. *Eng'ing*, March 24. The second instalment deals with the physics department, electricity, fundamental units, Weston standard cells, standard of resistance, Lorenz apparatus, general electric measurements, inductance, condensers, telephone cables, magnetic tests, wave meters, substandards in electrical engineering and photometry, supply meters, heating of lamp sockets, insulators, micanite, ebonite, direct-current and resistance measurements, cells, heating of cables, thermometry and pyrometry and petroleum flash tests.—Lond. *Eng'ing*, March 31. The third instalment deals with

metrology, silica standards of length, defraction gratings, Blythwood machine, porcelain soakages, taximeters, optics, photographic shutters, clinometers and levels, metallurgy and metallurgical chemistry alloys and the observatory department.—Lond. *Eng'ing*, April 21.

Definitions.—PASSAVANT.—With reference to the definitions recently proposed by the German Commission, the author objects to the definition of generator and motor as machines for transforming mechanical power (Leistung) into electrical power and reversely. He emphasizes that it is not the power but the work (Arbeit) or energy which is transformed.—*Elek. Zeit.*, March 30.

Telegraphy, Telephony and Signals.

International Telephone Conference.—DEVAUX-CHARBONELL.—The conclusion of his report of the second International Conference of Telephone and Telegraph Engineers recently held in Paris. In the present instalment the papers on standardization, rules for high-tension wires and telegraph and telephone wires when being placed near together, papers on long-distance telephony, on the impregnation of wooden poles and on high-efficiency telegraph systems are summarized.—*La Lumière Elec.*, April 22.

Loud-Speaking Telephone.—An illustrated note on the use of loud-speaking telephones at a crowded tramway stopping place at Blackfriars Bridge in London for facilitating the loading of the cars with passengers. The transmitter is a carbon-granule instrument with carbon diaphragm, and the set is direct-working, no induction coil being used. The receivers are fitted with megaphones.—Lond. *Elec. Eng'ing*, April 27.

Miscellaneous.

American Electrical Industry.—A. GERARD.—A long report based on his observations during a trip through the United States on the American electrical industries.—*Bull. de l'Ass. Inst. Elec. Montefiori*, Vol. 10, third series, 1910. Briefly abstracted in *La Lumière Elec.*, April 22.

BOOK REVIEW.

DIE VEKTORANALYSIS UND IHRE ANWENDUNG IN DER THEORETISCHEN PHYSIK. By Dr. W. v. Ignatowsky. Leipzig: B. G. Teubner. Two volumes, 235 pages, 41 illus. Price, 6 marks.

This is an excellent mathematical text-book on vector analysis, written for students of mathematical physics. It deals with the subject in a very practical way, allowance, of course, being made for the difficulty of the task. The first volume deals with the theory of vectors and vector algebra. The second volume discusses applications of that theory to mechanics and electrodynamics.

The vector analysis here developed is not to be confused with quaternions, although these sciences have much in common. According to this treatise, and in conformity with many modern writers, the square of a unit vector in any direction is a solar unit positive quantity; whereas in quarternions it is a scalar unit negative quantity.

The book will be useful to advanced students of physics and mathematics.

New Apparatus and Appliances

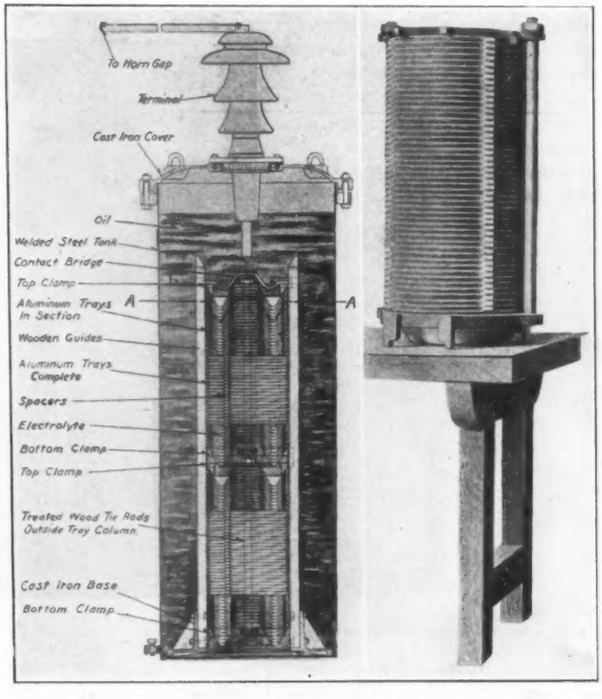
DESIGN FEATURES OF ELECTROLYTIC LIGHTNING ARRESTERS.

Oil in the tanks of electrolytic lightning arresters is in contact with the electrolyte in the trays. It, therefore, soon absorbs moisture from the electrolyte. It has been found that organic substances, such as wood or fiber, when used between electrolytic arrester trays absorb moisture from the "wet" oil and thereby become conducting. They carbonize and difficulties ensue. In order to avoid trouble from this condition in the electrolytic arresters here shown separators of porcelain are used between the trays. The wooden tie rods which bind the tray structure together are not in contact with any trays except the top and bottom ones of each section. The rods are supported in clear oil.

Fig. 3, which is a sectional view of three trays filled with electrolyte, shows how the separators are inserted. Four separators are used between each pair of trays. Each stack of trays and separators is clamped with iron nuts turning on the threaded end of wooden tie rods, as shown in Fig. 2.

In each electrolytic arrester tray there are four holes which, when the trays are stacked, form a vertical oil duct through which oil can circulate. This promotes the discharge of bubbles from the electrolyte and assists in maintaining an arrester at a low temperature when it is operating continuously for a long period. Another feature that assists in the effective discharge of bubbles is the contour of the tray. It will be noted from Fig. 1 that the outer portion of each tray is of such shape and so inclined that bubbles forming in the electrolyte will be discharged directly into the oil. A horizontal lip formed around the tray edge would constitute a pocket which would obstruct the bubble discharge. Therefore such construction has been avoided.

Tray structures for these electrolytic arresters are divided into sections or units, as indicated in Fig. 1. Each section is small enough so that it can be readily handled by one man when he is putting it in or withdrawing it from a tank.



Figs. 1 and 2—Section and Assembly Views of Tray Structures.

Ample oil space is provided between the tray structure and the inner surface of the sheet-iron tank. In computing the

clearance necessary between the trays and tank for sufficient insulation it has been assumed that the oil would always be "wet." Two very desirable things accrue because of the allowance of this liberal clearance. One is that the oil volume, hence the ability of the arrester to discharge continuously, is greatly

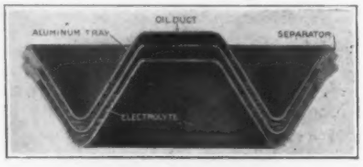


Fig. 3—Sectional View of Trays.

increased. The other is that it is not necessary to hang a circular screen of some organic insulating material down in the tank around the tray structure in order to prevent arcing between the trays and the tank. These arresters are built by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

SOLENOID-OPERATED OIL-BREAK SWITCH.

The oil-break switch here shown has been designed for use on circuits where the potential does not exceed 15,000 volts. Use is made of a straight-line operating mechanism which, with the exception of the operating lever and its connecting link, is entirely mounted upon the switch frame. This mechanism gives a vertical parallel movement to the movable contact blades, which obviates the danger of friction or binding and increases the speed of the switch break. This mechanism is adjusted at the factory and requires no further adjustment.

The fixed contacts are of the drop-forged-copper, flared-finger type. The movable contacts are wedge-shaped copper blades, each provided with a slot in the upper extremity, thereby permitting a jet of oil to be forced into the arc on rupturing the circuit. This assists in extinguishing the arc quickly and reduces the disturbance in the oil vesssel.

This construction insures clean contact surfaces and good contact under pressure over the entire surface and also prevents burning and pitting the contact surfaces, inasmuch as the arc is not ruptured between the actual contact surfaces, but between the upper extremity of the moving contact and the flared portion of the stationary contact.

The insulators are of one-piece glazed porcelain corrugated to give large creepage surface. Each insulator extends below the oil level and is clamped to the frame by two metal plates and four cap screws, eliminating the use of babbitt or cement. The insulators are interchangeable.

The switch, being a self-contained unit, can be conveniently handled and installed without interfering with the alignment. It has been placed on the market by the General Electric Company.

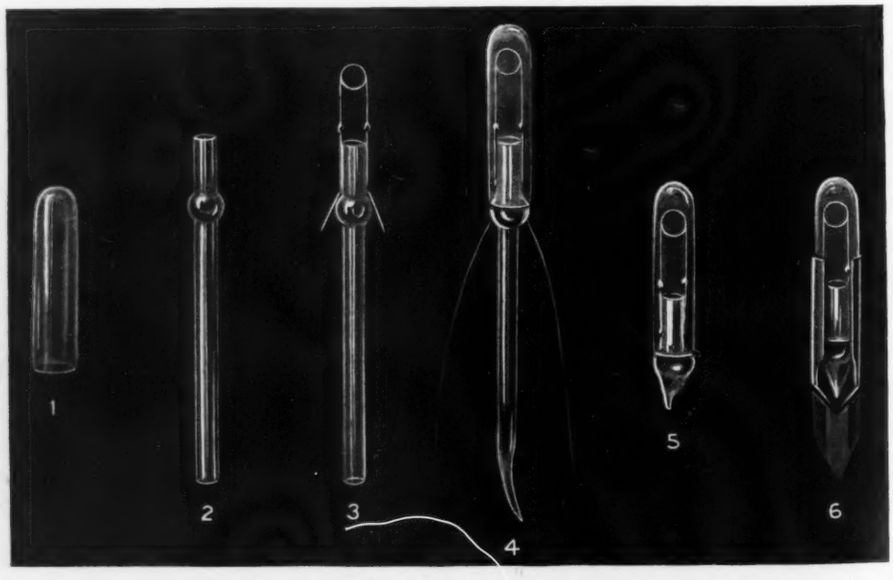
Solenoid-Operated Oil Switch.

THE MANUFACTURE OF SMALL INCANDESCENT LAMPS.

Manufacturing an efficient and satisfactory incandescent lamp for switchboard service has been something of a problem, and to turn out these lamps in large quantities is a task of unusual interest and one that involves extremely delicate operations. It must be remembered that the carbon filament contained in this glass globe, 0.25 in. in diameter, has a diameter equal to that of the human hair. When this and the other unusual conditions are taken into account, it may well be said that the efforts of the manufacturers have been highly successful.

To produce a lamp that will give service for the greatest length of time has been the object of much of the development of types. To determine to what extent this has been accomplished some interesting tests have been carried on at the Hawthorne plant of the Western Electric Company. The lamps under test were those which have been adopted as standard for telephone switchboard use.

Life tests regularly carried on by this company show that the lamps have an extremely long life when operated at usual voltages. In fact, the usual 1000-hour life tests show very few unsatisfactory lamps. In order to determine how long these lamps would operate, one of the test lots has been allowed to remain in use continuously since 1903. No change from the original condition of the lamps, so far as a satisfactory signal is concerned, has occurred during the more than 50,000 hours in which the lamps have been in service. Intermittent lighting up of the lamp, similar to that given in switchboard service, in no way shortens the life of the lamp, even when the flashing has occurred over 1,000,000 times.



Actual Size of Switchboard Lamp in Process of Manufacture.
1. Lamp cap. 2. Lamp stem unmounted. 3. Lamp stem with filament complete. 4. Lamp after pumping. 5. Lamp ready for terminal. 6. Finished product.

Early in the development of the lamps the size became fixed with dimensions of 5/16 in. in diameter and 1¾ in. in length. The standard line lamp is designed to give a satisfactory signal on 24 volts, consuming slightly less than 0.1 amp. The problem

of placing a filament with a resistance of 250 ohms or more in a glass globe ¼ in. in diameter was well-nigh impossible in the early days, but improved methods in manufacture have made it possible to place filaments with a resistance even as high as 1000 ohms within the standard dimensions of switchboard lamps.

A metal filament, such as tungsten or tantalum, being of much lower resistance than the carbon, is not ideal for the voltages and currents now considered standard for telephone work. Accordingly the development of the filament has been along the lines considered standard for carbon filament.

Cotton of filter paper is dissolved in a strong solution of zinc chloride, one of the most corrosive and troublesome liquids that we have. The result is a solution very similar in appearance to glucose, but full of little air bubbles, every one of which must be removed or the filament will not be satisfactory. Of the so-called cellulose thus formed there are two very pure forms. After it has been dissolved in the zinc chloride it is called amyloid, and when it is squirted through a small die or tube into the alcohol it forms a beautiful thread, not very strong but of wonderful properties. The alcohol removes the zinc chloride, precipitates and hardens the cellulose. The filament is squirted into the form of a ring on the bottom of a glass jar. This ring increases in height until there are at times thousands of feet of the filament in each jar. It is a difficult problem to remove this filament, dry and stretch it without tangling. Amyloid in this form has the property of shrinking almost indefinitely in every direction, and in order to make it suitable as to uniformity in lamps careful drying must be adopted. The average size of the human hair is about 0.002 in. in diameter, and this is just the size of the filament thread after being dried and stretched. Only girls who have perfect eyesight and delicate hands can handle this work at all satisfactorily, and even then the difficulty is very great.

This thread looks very much like a violin string, although it is not nearly so strong, and it is wound in suitable shape on carbon blocks preparatory to changing of the cellulose thread to a pure carbon filament. The blocks of carbon with their load of thread properly attached are then placed in a brass molder's graphite crucible and packed thoroughly with pure powdered carbon. The cover of the crucible is fastened on and the crucible is placed in a gas or oil furnace, the temperature which must reach the highest point that the crucible will withstand.

The filament, being away from all air, changes over to very hard and elastic carbon of a most durable kind. It is tested for quality, resistance and size before being sent to the operators who mount the filaments on the stems. The electrical resistance of the lamps must be within the predetermined limits, and the uniformity of the filament from end to end must be perfect. Thousands of lamps are being made every month by the Western Electric Company with a filament having a cross-section of one-quarter that of the standard. It is almost impossible to see these filaments with the naked eye, unless in a strong light and with a white background. By great ingenuity and expert workmanship it has been found possible to make a curled filament having a loop in it of over 1000 ohms resistance when hot, and still be able to place it in the standard-size miniature lamp having a globe 0.25 in. in diameter. This lamp gives a satisfactory signal or illumination with 35 milliamperes of current and gives a satisfactory life on 48 volts, although it is usually operated anywhere from 35 volts to 48 volts.

In order to make the filament within the proper range and to secure a satisfactory service for a long life it is necessary to operate each filament in a vapor of gasoline or other hydrocarbon. When it becomes quite hot in the presence of a hydrocarbon vapor the gasoline is decomposed and a very thin coating of fine carbon or graphite is deposited on the red-hot filament.

The lamp globe is a high-quality glass tube rounded on the front end, 0.25 in. in diameter and about 1 in. in length. The stem, on which has been mounted the filament, is inserted in the open end and sealed so that it is air-tight along the outside portion of the stem. The air is later exhausted through the small hole in the center of the stem and closed up tight so as to prevent the air getting back into the lamp.

The stem is prepared from ⅛-in. tubing. The mounting wires, where they pass through the glass globe, are made of pure platinum. The filament is fastened to the mount or stem wires by means of a carbon cement, which is of such a character that it will not retain gases which may be occluded within its surface or given off from any binder which may hold the carbon together.

There are two standard ways of exhausting an incandescent lamp—one with mercury-vacuum pumps and the other with the mechanical vacuum pump with the use of red phosphorus for the final removal of the oxygen. The mercury pumps have been discarded for many years by the large incandescent-lamp manufacturers, but for the miniature lamps some manufacturers still retain them in spite of their delicate design and expensive maintenance. The quality of the vacuum in a switchboard lamp must be much higher than that of the ordinary incandescent lamp. The filament is so close to the walls of the lamp that the heat-insulating quality of the vacuum must be well-nigh perfect in order to prevent the heat from the filament rapidly passing into the air. The vacuum must also be very nearly perfect so that the extremely small diameter filament will not be burned by any trace of oxygen remaining.

To all lamps is given a thorough inspection for possible defects. Tests must be made in a few hours which in a way represent the actual operating condition of the lamp in service. As a defect in any part of the lamp may cause failure in the final product very great precautions have been taken to arrange every portion so that the lamps will have the maximum reliability. How well this has been done may be judged from the fact that the great majority of the lamps will operate many thousands of hours before burning out, and that the uniformity of candle-power is all that is necessary for the class of service required.

MOTOR SPEED REGULATOR.

The speed regulator here illustrated combines in one device a regulating rheostat for decreasing the speed of a motor and also for increasing the speed above normal. One operating lever performs the function of starting, increasing and decreasing the motor speed. Increasing of the speed above normal is accomplished by inserting external resistance in the shunt-field circuit of a shunt or compound motor. This regulator provides 100 per cent variation by field control and 50 per cent by armature resistance. It is well adapted for controlling the speed of motor-driven fans and machine tools where large variations are desired and only one voltage is available. The device is compact, has only one lever, automatic release from any point, and renewable segments. It has been placed on the market in sizes from 0.25 hp to 50 hp for 115-volt, 230-volt and 500-volt circuits in two separate types, the fan type and the machine type, by the Cutler-Hammer Manufacturing Company, Milwaukee.

Motor Speed Regulator.

Industrial and Commercial News

The Week in Trade.

LAST Monday, after the close of general business, the Supreme Court of the United States announced its decision in the case of the Standard Oil Company, ruling that the Standard Oil Company is a combination in unreasonable restraint of trade. The court sustained the decree of the lower court calling for dissolution of the Standard Oil Company, but extended the period of execution from thirty days to six months, and provided a further modification vacating the injunction against interstate commerce in petroleum and products prior to dissolution. The bringing of the word "unreasonable" into the law is now the subject of extensive comment. The point is recalled that neither the size of a corporation nor the magnitude of its operations makes it liable under the law. The points at issue are whether a combination controls output or fixes prices. The decision is so far-reaching in its effect upon the affairs of the country that it is doubtful if trade will respond at once, now that the ruling has been made known. There has been little change as yet. Good weather has prevailed throughout the week, and a fair amount of new business has been done in retail lines, and, although the activity has been on too small a scale to cause briskness in wholesale and jobbing trades, it has been of an encouraging nature. There are, further, many grounds upon which to base an optimistic view of the situation. Among these may be mentioned the growth of export business, April figures for New York showing $71,841,000, as compared with $48,346,000 for the same month in 1910. There has been no disquieting news from the farming sections and advices still point to large harvests, with the government report on growing wheat indicating a record yield; and the foreign credit of the country is larger than it has been for many years. Business failures for the week ended May 11, as reported by *Bradstreet's*, were 245, as compared with 234 last week, 216 in the same week of 1910, 224 in 1909, 281 in 1908 and 184 in 1907.

The Copper Market.

THE efforts of the smaller producers to dispose of their products have resulted in lower prices, both in this country and abroad, the market barely reaching a 12-cent basis. The majority of the few contracts have been obtained by the independents as the result of underselling the Amalgamated interests. Some electrolytic sales for June and July shipment were made at prices ranging from 11.90 cents to 12 cents cash, but these have been on too small a scale to cause any change in the dullness of the market. The declining demand for steel products has apparently reacted upon the copper trade, and the wire-drawing interests are practically the only users acquiring supplies at this time in amounts approaching the takings of last year. The rolling mill and foundry interests are showing no improvement and are reported as operating well under capacity. In some cases the foundries are said to be working upon part time. Speculative interest in standard copper continues on a mild scale, both here and abroad. A falling off from 10 to 15 points has occurred in New York, and with offerings from spot to August ranging from 11.60 cents to 11.65 cents bidding has not exceeded 11.55 cents. In spite of the activity abroad, there is only a moderate call for American copper from foreign interests. Imports are now at the rate of 15,000 tons for the month, and with an estimated monthly output of 125,000,000 lb. domestic deliveries will have to approach 65,000,000 lb. and exports must amount to some 60,000,000 lb. in order to effect a balance between output and consumption. With the slackness in the majority of lines and the period of the year there is little likelihood that the showing for May will be greatly better than that of April. Exports for the month, including May 15, were 12,175 tons. The daily call on the Metal Exchange May 15 quoted standard copper as per the accompanying table.

Standard Copper.	Bid.	Asked.	Settling Price.
Spot	11.55	11.65	.....
May	11.50	11.60	11.55
June	11.50	11.65	11.57½
July	11.50	11.60	11.55
August	11.50	11.65	11.57½

The London market, May 15, was as follows:

	Noon. £ s d	Closing. £ s d
Standard copper, spot	53 8 9	53 8 9
Standard copper, futures	54 1 3	54 1 3

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	12.30c	11.57½c
London, spot	£56 15 0	£53 8 9
London, futures	57 12 6	54 1 3
Best selected	60 5 0	57 5 0

Industrial and Commercial Notes.

Western Electric Gives Able Assistance.—Record work was done by the Western Electric Company in rushing an emergency switchboard to the exchange of the New England Telephone & Telegraph Company, at Bangor, Maine, on the occasion of the $6,000,000 fire on the evening of April 30. Although the fire was not under control until the next morning, the emergency exchange was started from the New York factory by 11:30 Sunday night. As soon as the fire had reached the telephone exchange word was dispatched to the Boston house of the manufacturers. A telephone message was immediately sent to the executive offices of the Western Electric Company at New York, at which point emergency equipment is kept for such purposes. Notwithstanding the fact that it was on a Sunday, when the activities at the factory were at a standstill, and the added difficulty of the lateness of the hour, a force was quickly assembled and seven trucks were brought to the spot. The equipment, which was sent on to Bangor by way of Albany on the first passenger express Monday morning, weighed 50,000 lb. and filled two cars. It consisted of seven sections of central-battery, lamp-signal board arranged for 3000 subscribers' lines. A power-plant equipment for its operation was included. The switchboard arrived in Bangor at 3 o'clock Wednesday morning, and a force of men immediately began installing it in a dance hall which had been spared by the flames. The emergency equipment will give service at Bangor until a new exchange can be planned and built.

New York Companies Reduce Rates.—The New York Edison Company and the United Electric Light & Power Company have notified the Public Service Commission that, beginning July 1 next, they will put into effect a new schedule of rates for electric energy, which will mean a saving to their customers of $1,250,000 per annum, based upon the present consumption of electricity. In making these new rates the companies have yielded to the arguments of the Public Service Commission, which for more than two years has been urging upon them the advisability of a simplification of contract forms and a reduction in the prices charged for energy. The commission's investigation into electric lighting matters was conducted by Commissioner Milo R. Maltbie, through whose efforts the promised reductions have been obtained. In speaking of the changes, Commissioner Maltbie said, in part: "According to the new rates everyone using over $25 worth of energy a month will receive a discount ordinarily ranging from 5 per cent. to 25 per cent." Details of the new schedule will be found in another section of this issue.

Westinghouse Traction Sales.—The $400,000 order received by the Westinghouse Electric & Manufacturing Company from the Southern Power Company, mentioned in the issue of May 11, calls for ten 500-kw motor-generator sets, fourteen 55-ton locomotives and twenty-three 90-hp quadruple motor equipments, together with transmission and substation equipment. This apparatus will be used on the lines of the Greenville, Spartanburg & Anderson Railway and branches controlled by the Piedmont syndicate. The Westinghouse Company will furnish thirty double car equipments to the New York, Westchester & Boston Railway Company, and a number of traction equipments to the Boston Elevated Company.

Converter for McAdoo Road.—The Hudson & Manhattan Railroad Company has placed an order with the General Electric Company for a 1500-kw rotary converter. This is for railway service, and will be a six-phase, 600-volt unit, operating at 200 r.p.m.

Efficient Emergency Service.—Prompt action by large electrical manufacturers has shortened delay in restoring working conditions after several recent fires. Following the $500,000 fire at the Arbuckle sugar refinery, Brooklyn, N. Y., the General Electric Company was awarded a contract to replace all damaged electrical equipment, and most of the new apparatus was available from stock, the balance being of special design, upon which work is rapidly progressing. The generating station at the Arbuckle works contained four 300-kw and one 150-kw General Electric generators, direct-connected to MacIntosh & Seymour engines, which operate non-condensing, at 150 r.p.m., and carry a twenty-four-hour load. These units furnish direct current at 230 volts for fifty motors, and have been in service twelve years. When the fire started, at 7:30 p. m., all of the machines were shut down, with the exception of one 300-kw set, which was run to furnish lighting and elevator service. This unit was finally short-circuited by the salt water from the fire-boats and the high-pressure system, and all of the apparatus was thoroughly drenched. When repairs were started, the salt water in the generators was washed out with fresh water, and the generators were surrounded with coke fires, made in galvanized buckets with holes bored near the bottoms for draft. This drying process was carried on for two days, after which the machines were started, and carried loads, with no marked defects. About fifty motors, aggregating 800 hp, were destroyed, together with their individual panels containing circuit-breakers, switches and starting devices. New motors have been ordered from the General Electric Company. There are nineteen 20-hp motors of special design for operating sugar centrifugals being completed at the General Electric shops. These motors have heavily compounded fields, enabling the centrifugals to attain full speed under load in about one minute. The main switchboard, of Vermont marble, was wet by salt water, but was not damaged. It is expected that the refinery will be in operation within one month.

Southwestern Telephone Matters.—With further reference to the building of a new telephone line in Texas, as mentioned in the issue of April 27, it is learned that when the American Bell Telephone Company purchased the control of the Western Union Telegraph Company, some months ago, the Bell Telephone interests also owned the only telegraph lines which compete with the Western Union Telegraph Company in this section. These lines are held by a company known as the Postal Telegraph-Cable Company of Texas, and connected with the extensive Postal Telegraph lines (the Mackay system) throughout the United States. The contract which the Postal company had with the Texas company contained a provision to the effect that in the event of the Texas company and the Western Union Telegraph Company property coming at any time under the same control, directly or indirectly, the contract might be terminated forthwith by the Postal company. Since this happened when the Bell Telephone Company absorbed the Western Union, the Postal Company served notice on the Texas company terminating the contract, which is now running from day to day. This was done so that the Postal Telegraph lines (the Mackay system), throughout the United States, would in no way be involved in the merger. Following this action, the telephone interests in control of the Texas Postal lines offered to sell those lines to the Postal Telegraph-Cable Company, asking what the latter states was an exorbitant price. In view of this the Postal Telegraph-Cable Company proper, whose corporate name in Texas is the Mackay Telegraph & Cable Company, has decided to build its own lines throughout the territory covered by the Texas Postal, and has already commenced work thereon.

Portland, Gray & Lewiston Equipment.—An order has been placed with the General Electric Company for the equipment of the Portland, Gray & Lewiston Railroad, which will run from Portland to Lewiston, Me., a distance of 30 miles. The average radius of curves is to be about 3000 ft. A car will leave each hour from both the Portland and Lewiston terminals, and every other car is to be an express, making the run of 30 miles in 45 minutes. The order includes three substation equipments, each consisting of a 300-kw rotary converter, with transformers and switchboard. The switchboard in substation No. 1 will consist of a 10,000-volt incoming line and transformer panel; one rotary converter panel, and a 600-volt, direct-current rotary converter panel. The energy is received from the Lewiston & Auburn Electric Light Company at a potential of 10,000 volts, the emf being raised to 33,000 volts for transmission to substations Nos. 2 and 3. The switchboard in No. 2 will consist of an incoming line and rotary converter panel, direct-current rotary converter panel, and two 600-volt direct-current feeders. The switchboard of No. 3 is the same as that of No. 2, except there is only one 600-volt direct-current feeder. The order also includes an equipment for a general-utility car which will be used in construction work for the present. The equipment consists of a quadruple General Electric, 210-car equipment with type M control.

Earnings of Philadelphia Company.—Gross earnings of the Philadelphia Company for the year ended March 31 were $6,538,840, which represents a decrease of $72,093, compared with the showing of the previous year. Operating expenses amounted to $2,513,910, an increase of $53,758, leaving net earnings of $4,024,930, which are $125,851 under those of the preceding year. This was offset by an increase in other income, of $153,771, bringing this item to $2,505,775, which made a total income of $6,530,705, an increase of $27,920. Charges decreased by $62,376, with a resultant increase of $90,296 in net income, which totaled $5,264,437. The allowance for betterments and improvements was $1,633,827, an increase of $591,030, leaving a balance of $3,630,610 available for dividends, this amount being $500,734 smaller than for the year ended March 31,1910. The balance after payment of dividends, which were $522,613 larger on common stock than paid the previous year, was $772,203, showing a falling off of $1,023,347. Further deductions left a surplus of $451,816, bringing the profit-and-loss surplus at the end of the year to $5,062,594.

Marine Turbines for Government.—The Westinghouse Machine Company has completed two marine turbines with reduction gears for use upon the U. S. collier *Neptune*. One set is now being installed, and the other is to be shipped Saturday of this week, and installed as soon as possible in order to make official trials early in June. The turbine and equipment being installed upon the *Neptune* represent over five years of study and experiment in the works of the Westinghouse Machine Company in developing turbine machinery for the propulsion of ships. The tests of these units are regarded in marine circles as of great importance, owing to the small space occupied by the turbines, decreased weight, and to the fact that with the higher speed permissible by the use of reduction gears it is expected that the steam consumption will be from 20 per cent to 30 per cent less than that necessitated by any other form of marine propulsion.

Pennsylvania & New York Telephone Sale.—Announcement is made that a special meeting of the stockholders of the Bell Telephone Company of Pennsylvania will be held at noon on July 18, to vote upon an agreement for the sale of all outstanding and issued capital stock, franchises and interests of the Pennsylvania & New York Telephone & Telegraph Company to the Bell Telephone Company of Pennsylvania, at $100 for each share of stock surrendered. A special meeting of the stockholders of the Pennsylvania & New York Telephone & Telegraph Company will be held on the same day at 11:30 a. m. to vote upon the proposed sale.

Westinghouse, Church, Kerr & Company Elections.—John F. Wallace, formerly chief engineer of the Panama Canal, has succeeded H. H. Westinghouse as president of Westinghouse, Church, Kerr & Company. H. W. Halsey and F. Q. Brown, of New York, George Westinghouse and J. R. McGinley, of Pittsburgh, and Homer Loring, of Boston, have been elected directors. Mr. Wallace will continue as chairman of the board of the company and also as president of the Electric Properties Company, which is the controlling organization.

Southern Minnesota Utilities.—With the completion of the plants of the Northern States Power Company, it is understood that the electric service properties in the majority of the smaller towns in southern Minnesota will be transferred to H. M. Byllesby & Company, of Chicago. A. S. Huey, vice-president of the Byllesby Company, has been making a tour of inspection of the company's plants on the Apple River, near Somerset, Wis., and announcements relative to the above are expected shortly.

Fire in Canadian Works of Allis-Chalmers Company.—As the result of a fire on May 6, the works of Allis-Chalmers-Bullock, Ltd., near Montreal, Canada, sustained damage estimated at $75,000. The fire started in the winding and testing department.

Financial.

The Week in Wall Street.

With the future policy of so many of the greatest industries of the country depending upon the nature of the decisions of the Supreme Court, there has naturally been a tendency to withhold commitments of any sort, either in stock transactions or in general trade, until the outcome is more clearly defined. Prior to the announcement of the decision of the Supreme Court in the case of the Standard Oil last Monday, the same narrow business prevailed in Wall Street as has been the case in other weeks when the rulings were expected. Trading was merely automatic, and price changes unimportant. The transactions for the week were only 1,079,952 shares, as compared with the narrow total of 2,269,399 for the previous week. There has been a decrease in the activity of the bond market, but the tone continues firm and the lighter volume at present is probably due to the fact that investment demand is temporarily satisfied. Short-term issues are still the dominating feature of the bond market, as was the case last week. In addition to the ruling of the Supreme Court, another feature of the week was the government report of foreign trade for the month of April. The total exports were $158,004,276, showing an increase of $25,000,000 for the same month in 1910. The excess of exports over imports was $7,878,094, comparing favorably with $835,620 for this item in April of the previous year. The present status of the money market clearly indicates the condition of general trade, and any increase of moment in the low rates now quoted would be welcomed as a sign of returning activity. Rates May 15 were: Call, 2@2¼ per cent; ninety days, 2¾ per cent. The quotations in the tables are those of the close, May 15.

NEW YORK.

	May 8.	May 15.	Shares Sold.		May 8.	May 15.	Shares Sold.
All. Ch.....	7½	7⅛*	110	Int. Met., pf.	53¼	52	6,100
All. Ch., pf...	27	28*	210	Mackay Cos..	90½	90	200
Amal. Cop...	63	63	10,425	Mackay C., pf.	75⅝*	76¼*	100
Am. D. T...	20½*	20½*	———	Man. Elev....	135*	135	100
Am. Loco....	38*	37⅝*	200	Met. St. Ry..	15*	15*	———
Am. Loco.,pf.	104⅞*	106¼*	100	N.Y.&N.J.Tel.	139½*	139½*	———
Am. Tel. & C.	82½*	82½*	———	Steel, com....	74½	75⅝	225,725
Am. T. & T..	148⅜	148¼	6,300	Steel, pfd....	119	118⅜	3,484
B. R. T.....	78¾	78¾	12,300	W. U. T....	74½	74¾	2,400
Gen. Elec...	156¼	156	2,100	West'h, com..	68*	69	600
Int. Met.....	19	18¼	7,600	West'h, pfd..	117*	110	———

PHILADELPHIA.

	May 8.	May 15.		May 8.	May 15.
Am. Rys.....	44	44	Phila. Elec.....	16½	16⅝
El. Co. of A.....	12*	12⅛*	Phila. R. T.....	17¼*	18⅛
Elec. St. B'ty.....	52¾*	53*	Phila. Trac.....	82½	83½
Elec. St. B'ty., pfd.	30*	30*	Union Trac.....	45¾	46¾

CHICAGO.

	May 8.	May 15.		May 8.	May 15.
Chi. City Ry.....	186*	186*	Chi. Tel. Co.....	124*	122*
Chi. Rs., Ser. 1....	80*	80*	Met. El. Co.....	22⅛*	22⅛*
Chi. Rs., Ser. 2....	21¾	21*	Met. El., pfd.....	67¼	67*
Com. Edison.....	125*	128¾	Nat'l Car.....	115	118¼
Chi. Subways.....	4⅞	4¾*	Nat'l Car, pfd.....	120*	120*

BOSTON.

	May 8.	May 15.		May 8.	May 15.
Am. T. & T.....	148¾	148¼	Mex. Tel.....	4*	4*
Cum. Tel.....	150*	150*	Mex. Tel., pfd.....	6¼*	6*
Edison E. Ill.....	287¼	287	N. E. Tel.....	143	144½
Gen. Elec.....	157	156¾	W. T. & T.....	20¼*	19*
Mass. E. Ry.....	18½	18⅞	W. T. & T., pfd....	94½*	94¼*
Mass E. Ry., pf....	88	88½			

*Last price quoted.
Shares sold for week May 8 to May 13.

Financial Notes

American Light & Traction Earnings.—A report of the American Light & Traction Company for twelve months ended March 31 shows continued improvement in the operations of the company. The gross earnings in this period were $3,933,031, comparing favorably with $3,463,580 in 1910, and $2,289,000 in 1907. Net earnings were $3,813,570, representing an increase of $457,435 over this item for the 1910 period. During the twelve months ended March 31, 1911, the dividends paid on the common stock amounted to $1,022,327 in cash and $1,002,505 in stock. The cash dividend for the previous year was $858,794, and the stock dividend, $1,530,917. Operating expenses were $119,521, against $107,445 for twelve months ended March 31, 1910, a small increase relative to the increased business done. The surplus balance shown at the end of the 1911 period was about $7,150,000. This is divided into about $3,707,000 carried as undivided earnings and some $3,450,000 carried as reconstruction reserve. The surplus balance given for March 31, 1910, was $6,243,000, as compared with $6,131,563 for 1909, $4,486,467 for 1908, and $3,488,607 for 1907. The American Light & Traction Company, in the twelve months ended March 31, 1911, earned a surplus available for the common stock equal to nearly 28 per cent on the $10,611,100 outstanding.

Twin City Rapid Transit Business.—Gross business of the Twin City Rapid Transit Company for the first quarter of this year was nearly 6 per cent better than that for the same period last year. Operating expenses increased 9.17 per cent, the higher cost of conducting transportation being the largest item in this increase. This amounted to $622,972, which was 12.51 per cent higher than the figure of the previous year. Maintenance of way and structures decreased, however, being 6.42 per cent under last year's figure. The Twin City company earned 2.14 per cent in the first quarter of the current year upon the $20,100,000 common stock, against 2.03 per cent earned in the corresponding period of the previous year. After charges, taxes and dividends on preferred stock were provided for there was a surplus of $430,270, an increase of 5.04 per cent over the figures in 1910. With a quarterly dividend on common stock of 1½ per cent, amounting to $301,500, there has been discusison of increasing the dividend to a yearly basis of 7 per cent, but no change of the rate is planned for the present.

United Railways Investment Gains.—At the annual meeting of the United Railways Investment Company, which is the holding company for the United Railroads of San Francisco, the Philadelphia Company, the Railroads & Power Development Company, and others, Emil Loeb and Eben Richards were elected directors, succeeding M. Kubierskchy and C. S. Shepard. The annual report of the company for 1910 shows a surplus of $766,468, which is equivalent to 4.79 per cent on the $16,000,000 preferred stock, as compared with 32 per cent for the previous year. President Thalman says in his report to the stockholders that the acquisition of the Sierra & San Francisco Power Company has resulted in a substantial saving in the cost of energy.

Canadian Telephone Service.—The application of eleven independent telephone companies of western and central Ontario for an order directing the Bell Telephone Company to give these companies long-distance connection over its system has been granted by J. B. Mabee, chairman of the Dominion Board of Railway Commissioners. The order is provisional, containing a qualification which makes the act of obeying the board only an experiment. A twelve months' trial will be given to the connection, and in the event of satisfactory service the arrangement may be made permanent through the terms of the order.

Chicago Traction Company Chartered.—The Chicago, Waukegan & Woodstock Traction Company has been chartered, with an initial capital of $50,000,000. Plans will be made within a short time for a road to furnish passenger and freight service between Waukegan, Lake County, and Woodstock, McHenry County.

Dividends.

American Railways, quarterly, 1½ per cent, payable June 15.

Chippewa Valley Railway, Light & Power Company, quarterly, preferred, 1¾ per cent, payable June 1.

Columbus Railway Company, quarterly, 1¼ per cent, payable June 1.

Federal Light & Traction Company, quarterly, preferred, 1½ per cent, payable June 1.

Georgia Railway & Electric Company, quarterly, 2 per cent, payable May 20.

North American Company, quarterly, 1¼ per cent, payable July 1.

Washington (D. C.) Railway & Electric Company, common, 1 per cent; preferred, 2½ per cent, both payable June.

Reports of Earnings.

EDISON ELECTRIC ILLUMINATING COMPANY OF BOSTON.

	Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
April, 1911	$439,329	$184,780	$254,549	.....	.....
" 1910	393,600	171,645	221,955	.....	.....
10 mos., 1911	4,461,606	1,862,267	2,599,339	.....	.....
" 1910	3,990,346	1,779,457	2,210,889	.....	.....

LACLEDE GAS LIGHT COMPANY.

Qtr., Mar., 1911	$1,177,378	$567,365	$610,013	$63,456	$546,557
" " 1910	1,169,149	612,601	556,548	51,209	505,338

General News

Construction News.

EUFAULA, ALA.—We are informed that the Eufaula Gas, Electric Light & Power Company, of Eufaula, Ala., is not contemplating rebuilding its plant, as reported in our issue of March 9.

EUFAULA, ALA.—Bids will be received by the city of Eufaula until June 7 for equipment for a new electric plant, specifications for which may be obtained upon application to the W. L. Upton Company, Brown-Marx Building, Birmingham, Ala., consulting engineer.

FT. MORGAN, ALA.—Bids will be received at the office of the Constructing Quartermaster, Ft. Morgan, Ala., until June 2, for motor-driven deep-well pump, electric transmission line, switch panel, transformer, 4-in. cast-iron water main, etc. Plans and specifications may be seen at the above office and copies obtained by deposit of $10, which will be refunded upon return of same. Lieutenant Edwin F. Barlow is constructing quartermaster.

MARION, ALA.—The Marion Electric Company, recently incorporated, proposes to supply electricity and gas in Marion County, and also to deal in gas and electrical fixtures and supplies. The company is capitalized at $10,000 and the incorporators are: T. J. Krouse, Emma L. Krouse and R. K. Coe.

KINGMAN, ARIZ.—Arrangements are being made by the Desert Power & Water Company to issue bonds to the amount of $400,000, the proceeds to be used for enlarging its system. The proposed improvements include the installation of additional machinery and extension of its transmission lines to the chloride district. The company at present supplies electricity to a number of mines in the Kingman district, among them being the Gold Road, Tom Reed and Hercules mining properties.

YUMA, ARIZ.—Contract has been awarded by the Secretary of the Interior at Washington, D. C., to Charles A. Haskin, of Boston, Mass., for a compressed air plant to be used in the construction of the siphon under the Colorado River in connection with the Yuma irrigation project. The lease includes the installation of the plant and the services of the contractor in starting it satisfactorily, together with the services of a competent superintendent during the progress of the work. This syphon, which is to be 1000 ft. long with a diameter of 15 ft., will connect the main canal on the California side with the irrigation system, which is to supply water to the broad valley below Yuma, Ariz. A power plant will be established later at the Arizona end to lift the water to the rich mesa lands in the immediate neighborhood of the town of Yuma.

HARRISBURG, ARK.—Plans are being prepared by L. D. Freeman and J. D. Gant for the construction of an electric railway to connect Marked Tree with Harrisburg and Newport, Ark., 50 miles in length.

BAKERSFIELD, CAL.—Preparations are being made by the San Joaquin Light & Power Company for the erection of a transmission line from the Crane Valley to Bakersfield. The proposed line will carry 60,000 volts and will extend along the west side of the valley, returning via the east side, making a loop of nearly 500 miles. The new transmission line to Waukena will soon be put into commission. Plans are also being made to build an extension to Angiola and Alpaugh. It is proposed to erect a substation at Stoil to distribute electricity in various directions.

BLYTHE, CAL.—Plans are being considered by the Blythe City Ice & Cold Storage Company for the construction of an electric-light and ice plant and creamery in Blythe. The cost of the plant is estimated at $40,000. J. B. Lockard and J. R. Dutcher are interested in the company.

LONG BEACH, CAL.—Plans are being made by the Home Telephone Company for extensive improvements to its local system, involving an expenditure of about $100,000. The work will include re-cabling the entire city and placing the cables in the business district underground.

LOS ANGELES, CAL.—The Board of County Supervisors has awarded the contract for installing electric fixtures in the new hall of records to the Thomas Day Company, of San Francisco, Cal., for $14,000.

LOS ANGELES, CAL.—Bids will be received by Harry Lelande, clerk of Board of County Supervisors of Los Angeles County, until June 5 for furnishing and installing a power plant, including a steam-driven electric generating unit, laundry equipment, steam cooking apparatus, ice plant, etc., at the Los Angeles County farm.

MERCED, CAL.—The Merced Land Company, of Los Angeles, Cal., has purchased a site on which it will erect an electric pumping plant in the near future. W. O. Huse is manager.

MONTEREY, CAL.—Plans are being considered for the installation of electroliers on Alvarado Street from California to Scott Street, the cost of which is estimated at from $4,500 to $5,000. W. H. McConnell is interested in the project.

REDWOOD CITY, CAL.—The Board of County Supervisors of San Mateo has granted a franchise to J. J. Gomes and Benjamin Cuncha to construct and operate an electric light and power system in the county north of Halfmoon Bay.

RIVERSIDE, CAL.—Bids will be received by the Board of Supervisors until May 24 for sale of franchise to erect and operate transmission lines to transmit electricity for lamps and motors along the public roads of Riverside County for a period of fifty years.

SAN FRANCISCO, CAL.—Plans are being considered by the Downtown Association for the installation of an ornamental lighting system, modeled after those in Vienna, decorated with real flowers. It is proposed to suspend flower boxes midway between the top and the bottom of the lamp standards. The flowers on the standards will be watered and cared for by an automatic arrangement. It will require about three months to install the system.

SAN JACINTO, CAL.—It is reported that improvements will be made to the local electric light system and new machinery installed. It is proposed to supply electricity for pumping purposes as well as for lamps.

DENVER, COL.—Application has been made by the Colorado Interurban Railroad Company for a charter to construct and operate an electric railway in the northern part of Colorado to connect Denver, Ft. Lupton, Greeley, Ft. Collins, Longmont and Idaho Creek. The railway will furnish both freight and passenger service. The company is capitalized at $6,000,000. The incorporators are: E. Armour, Charles H. Pierce, Irving Hale, James Leonard and others.

DANBURY, CONN.—The Danbury & Bethel Gas & Electric Company has applied to the State Legislature for authority to increase its capital stock from time to time to an amount not to exceed $600,000. The increase is asked for the purpose of taking up outstanding notes and to make further extensions to its system. The company now has $250,000 in capital stock and bonds to the amount of $150,000 outstanding.

NEW LONDON, CONN.—The Groton & Stonington Street Railroad Company has received authority from the State Legislature to amend its charter giving it the privilege to extend its railway in Mystic and to build an extension to Old Mystic, and has also been authorized to issue bonds to the amount of $100,000.

NEW LONDON, CONN.—Contracts have been awarded for the installation of the new water system at Fort H. G. Wright, N. Y., as follows: Construction of two pump houses, two electrically driven pumps, motors, etc., conduit and cable line to supply electricity to L. B. Jacobs, of Newark, Del., for $6,890; for 200,000-gal. reinforced concrete reservoir to McHarg-Barton Company, of New York, N. Y., for $11,000.

JACKSONVILLE, FLA.—The Board of Trustees of Water Works and Improvement Bonds has rejected all proposals for construction of the power house for the municipal electric plant. The board has decided to do the work.

PALATKA, FLA.—Application has been made to the City Council by F. P. Clarke, of Jacksonville, Fla., for a thirty-year franchise to construct and operate an electric light plant in Palatka. The cost of the proposed plant is estimated at from $40,000 to $50,000.

BARNESVILLE, GA.—Preparations are being made by the Aldora Mills to erect a new building 100 ft. x 240 ft., two stories high. Looms will be installed in the new building to weave the output of the 10,000 spindle plant of the company. The plant will be operated by electricity, which will be supplied by the local transmission system of the Central Georgia Power Company, of Macon, Ga. The cost of the proposed extension is estimated at $150,000.

DALTON, GA.—The City Council has awarded a contract to the Terrell-Hedges Company, of Chattanooga, Tenn., for the erection of the transmission lines for the new electric plant. The cost is not to exceed $5,100.

MARIETTA, GA.—At an election held recently the citizens voted to issue $20,000 in bonds, the proceeds to be used for improvements to the electric light system.

BOISE, IDAHO.—Plans are being considered by the Boise & Interurban Railway Company for the construction of an extension of its system from Boise to Roswell, via the Deer Flat country.

LEWISTON, IDAHO.—It is reported that the Lewiston-Clarkston Improvement Company has been granted a franchise to supply electricity in Lewiston for lamps and motors.

NEZ PERCE, IDAHO.—The Nez Perce Water Power Company, it is reported, is contemplating developing its water-power to the full capacity. It is estimated that 1500 hp can be developed. Z. A. Johnson is president of the company.

CARTHAGE, ILL.—It is reported that the Carthage Electric Light & Heat Company is contemplating installing additional equipment in its plant with a view of establishing a day service.

CHICAGO, ILL.—The Commercial Electric Motor Manufacturing Company has increased its capital stock from $10,000 to $50,000.

CHICAGO, ILL.—The Chicago, Waukegan & Woodstock Traction Company, recently incorporated, proposes to construct and operate a railway connecting Woodstock and Waukegan with the Northwestern and St.

Paul lines at these points. The McKenna motor car, which develops its own power, will be used. The company is capitalized at $50,000.

ANDERSON, IND.—The Board of Public Works and the railroads have reached an agreement by which the three steam roads will pay the city $850.80 per year for electric arc lamps at street crossings of the railroads. This is an increase of $300 over the amount paid last year.

GARY, IND.—Contracts will be awarded by the Gary, Hobart & Eastern Traction Company, of Gary, Ind., for the construction of an electric railway from Hobart to Broadway, Gary, five miles in length. George H. Hunter is interested in the project.

MUNCIE, IND.—The Muncie Electric Light Company, the Dunkirk Lighting Company, the Redkey Lighting Company, the Hartford City Lighting Company and the Eaton Electric Light Company have been consolidated under the name of the Muncie Electric Light Company. The new corporation is capitalized at $1,000,000. New lighting systems have been installed in Dunkirk and Redkey, and other towns in the territory will be supplied with electrical service in the near future.

ATLANTIC, IA.—A committee has been appointed to take steps toward the installation of electroliers in Atlanta, at an estimated cost of $4,000. Charles Chase, Clyde Campbell and others are members of the committee.

FT. DODGE, IA.—It is reported that the Northern Iowa Power Company is preparing plans for the construction of a large dam north of Ft. Dodge.

MOUNT VERNON, IA.—The Dows-Smith Company, of Cedar Rapids, Ia., and F. J. Cross, of Monticello, Ia., it is reported, have applied to the Council for a franchise to install an electric light plant in Mount Vernon.

NEW MARKET, IA.—The citizens have voted to grant a franchise to the Lee Electric Light Company, of Clarinda, Ia., to supply electricity for lamps and motors in New Market for a term of twenty-five years. The town has also entered into a contract with the company for lighting the streets of the village. A transmission line will be erected from Clarinda to New Market, a distance of 10 miles.

NICKERSON, KAN.—The question of establishing a municipal electric light plant and water works system in Nickerson is reported to be under consideration.

QUENEMO, KAN.—Power for operating the proposed municipal electric lighting system will be supplied by the Quenemo Milling Company. The cost of the system is estimated at about $6,000. I. C. Bushong, of Ottawa, Kan., is engineer.

JENKINS, KY.—The Consolidated Coal Company is reported to be contemplating developing the water-power of Elkhorn Creek to generate electricity for lamps and motors in connection with Letcher and Pike Counties coal land developments. Plans have not yet been completed for the hydroelectric power plant. A. T. Watson, of Fairmont, W. Va., is purchasing agent. Executive offices of the company are located in the Continental Trust Building, Baltimore, Md. Jenkins has not a postoffice.

OWENSBORO, KY.—Plans are being considered for the construction of an electric railway to connect Owensboro, Madisonville, Utica and Calhoun, 51 miles in length.

NEW ORLEANS, LA.—The United Public Utilities Company has applied for a charter to own and operate electric railways in New Orleans. The company is capitalized at $1,257,600, and the directors are: Lynn H. Dinkins, Silas I. Hyman, S. B. Smeath, S. Wexler, Charles P. Fenner and others.

PATTERSON, LA.—The Patterson Light & Power Company, recently incorporated with a capital stock of $3,000, is reported to have awarded contracts for machinery and equipment for its proposed electric plant in Patterson. The company proposes to supply electricity for lamps and motors in this city. Anderson Offutt, of New Orleans, La., is engineer in charge.

FREEPORT, MAINE.—The plant and holdings of the Freeport Electric Light, Heat & Power Company have been purchased by John R. Graham, of Freeport, Maine. Mr. Graham several months ago acquired the property of the Portland & Brunswick Street Railway Company, which supplies electricity for operating the system of the Freeport Electric Company. The Portland & Brunswick Railway extends from Freeport to Yarmouth.

BALTIMORE, MD.—Specifications for contract for supplying the municipal buildings with electricity have been prepared by Robert J. McCuen, superintendent of Department of Lamps and Lighting. The specifications provide for electrical service with and without lamp renewals.

BALTIMORE, MD.—The Consolidated Gas, Electric Light & Power Company and allied companies have applied to the Public Service Commission for permission to issue over $900,000 in bonds. The application asks for authority to issue $844,000 of the general mortgage bonds of the Consolidated Gas & Electric Light & Power Company, of which $262,000 is to be used for refunding purposes and the remaining $582,000 for extensions and improvements. Permission is also asked by the United Electric Light & Power Company for authority to issue $60,000 in bonds, to be used for refunding purposes.

FORT HOWARD, MD.—Sealed proposals will be received at the office of the Constructing Quartermaster, Fort Howard, Md., until June 12, for construction of electric light plant and electric lighting system. Further information furnished on application to the above office, and copies of plans and specifications will be furnished upon deposit of $10, which will be refunded upon return of plans.

BARRE, MASS.—The town of Barre has entered into a contract with the Connecticut River Power & Transmission Company for lighting the streets of the village for a term of ten years. The contract calls for the installation of eighty 60-cp tungsten lamps, at the rate of $20 each per year. It is expected to have the system in operation by Sept. 1. The Gardner Electric Company, a subsidiary of the Connecticut company, will supply the service.

CHARLTON, MASS.—The Webster & Southbridge Gas & Electric Company is contemplating extending its transmission line from Southbridge to Charlton Center. The company has a five-year contract for lighting the streets of the town and also to supply electricity to the Masonic Home. The proposed line will be 7 miles long. Application will soon be made for the franchise.

GLOUCESTER, MASS.—The New England Telephone Company has been granted a franchise for an underground conduit system from Gloucester to Manchester, a distance of 7 miles.

HUBBARDSTOWN, MASS.—The town officials have awarded a contract to the Connecticut River Power & Transmission Company to light the streets of the town with electricity for a term of ten years. Under the terms of the contract the company is to supply fifty tungsten lamps of 60 cp at the rate of $20 each per year. It is expected to have the street lighting system in operation by Sept. 1. The service will be supplied by the Gardner Electric Company, of Gardner, a subsidiary of the Connecticut company. W. A. Belcher, of Gardner, is superintendent of the Gardner company.

MANSFIELD, MASS.—F. H. Coyne & Company, of Foxboro, Mass., have submitted a proposition to the Selectmen offering to purchase the municipal electric light plant in Mansfield. It is understood that the company is willing to take over the plant for the amount of the funded indebtedness, which is between $70,000 and $80,000, and agrees to supply electricity to private consumers at the rate of 12½ cents per kw-hour. The present rate is 15 cents per kw-hour. The proposition will have to be submitted to the voters.

NORTH EASTON, MASS.—The question of lighting the town by electricity is reported to be under consideration.

ORANGE, MASS.—The Miller's River Street Railway Company is planning to begin work on construction of its proposed railway as soon as franchises are granted. The proposed railway will be 14 miles long and will connect Miller's Falls, Erving, Earley, West Orange and Orange. The company will purchase electricity for operating the railway. Daniel P. Abercrombie, Jr., is interested in the project.

WARE, MASS.—The directors of the Ware Electric Company have notified the stockholders of the company that Cabot, Thompson & Eustis have offered $135 per share for the stock, provided they can obtained at least 40 per cent of it.

WESTMINSTER MASS.—The Connecticut River Power & Transmission Company has been awarded a contract by the town of Westminster to supply electricity for lighting the streets of the town for a term of ten years. The contract provides for the installation of thirty-eight 60-cp tungsten lamps, at $20 per lamp per year. The service will be supplied by the Gardner Electric Light Company, of Gardner, a subsidiary of the Connecticut company.

BARAGA, MICH.—Preparations are being made by the village of Baraga for the installation of a municipal electric light plant and water works system.

MANISTEE, MICH.—The property of the Manistee Light & Traction Company, including the electric and gas systems and street railway, was sold May 6 to Francis M. Edwards, of Boston, Mass., for $145,000. It is understood that Mr. Edwards represents the majority of the bondholders.

BROWN VALLEY, MINN.—The installation of an electric light system in Brown Valley is reported to be under consideration.

DULUTH, MINN.—The Duluth-Edison Electric Company has submitted a proposition to the City Council offering to supply electricity for lighting the city along the lines of the contract now in force, providing all arc lamps now in use to be furnished at the rate of $45 each per year. This is to include groups of incandescent lamps, namely, two 16-cp lamps constituting one group and three groups being equal to one arc lamp, the number of arc lamps to be not less in number than now in use. The company offers to supply electricity to light the city hall, police headquarters and jail free of charge, also electricity for the proposed sign on the aerial bridge, the city to furnish the sign, and one arc lamp for each improved park without charge to the city. It also offers to supply electrical energy for lighting all fire halls, city hospital, public library and any other building maintained by the city, and for lamps for the canal piers at the rate of 5 cents per kw-hour, and energy for operating the aerial bridge at the rate of $50 per month. The company asks for a ten-year contract, giving the city the right to terminate it at the end of three years upon six months' notice. A plan for a reduction in the price of electricity for commercial and residence lighting is also included in the proposition. The City Council has appropriated $2,500 to secure the services of an electrical engineer to prepare plans and specifications for the construction of a municipal electric light plant. The contract with the Duluth-Edison Electric Company expires Sept. 1. Oscar Claussen, of St. Paul, Minn., and Charles L. Pillsbury, of Minneapolis, Minn., have been engaged as consulting engineers.

LITCHFIELD, MINN.—It is reported that plans are being considered to extend the municipal electric light system around the south side of Lake Ripley. The Council has authorized the installation of twenty-six ornamental lamp standards to cost $2,600.

MINNEAPOLIS, MINN.—The Minneapolis, St. Paul, Rochester & Dubuque Traction Company, it is reported, is contemplating the construction of a new power house on Twenty-sixth Street, in South Minneapolis, to cost about $100,000.

MINNEAPOLIS, MINN.—The Minneapolis Northern Suburban Railway Company, it is stated, will soon begin work on the construction of its proposed railway between Minneapolis and Anoka. About 15 miles will be built at first and gasoline cars operated. It is expected that the railroad will eventually be equipped for electrical operation.

MINNEAPOLIS, MINN.—The City Council is reported to have closed a contract with the Minneapolis General Electric Company to supply electricity to operate the new pumping equipment for a period of ten years at the rate of 4/10 of a cent per kw-hour. The contract provides that the city shall not use current between 4:30 and 6:30 p. m. daily, except Sundays, for four months in the year. The new equipment includes two centrifugal pumps, each having a daily capacity of 20,000,000 gal.

ST. PAUL, MINN.—The St. Paul Southern Railway Company is reported to be considering the erection of two power houses, one in Hastings and the other in Lake City, Minn.

VIRGINIA, MINN.—The question of purchasing the local electric light plant to be owned and operated by the municipality is reported to be under consideration.

WAYNESBORO, MISS.—It is reported that M. A. O'Dom, agent, is contemplating the installation of an alternating-current generator, with sufficient output to supply electricity for 1000 lamps.

CARTHAGE, MO.—The Empire District Electric Company, of Joplin, Mo., has purchased the plant and holdings of the Empire Electric Power & Supply Company, of Carthage, Mo. The price paid for the property is said to be $50,000. It is understood that the new owners will extend and improve the service. Dr. C. B. Guinn, of Carthage, Mo., is president of the Empire Electric Power & Supply Company.

CHILLICOTHE, MO.—Contracts have been awarded by the city of Chillicothe, Mo., for construction and equipment of a municipal electric light system as follows: For concrete work, floor machinery and building foundations, boiler and equipment to J. E. Weeks, of Chillicothe, Mo., for $7,289; construction of power house to John Geir, of Chillicothe, Mo., for $5,740; brick and concrete chimney to Metal Concrete Chimney Company, of St. Louis, Mo., at $1,440; for two four-valve steam engines, pipe work and steam specials, two 400-kva generators, pole line complete, including 280 streets lamps, to the Squire Electric Construction Company, of Kansas City, Mo., for $30,405; deep well for water supply to Bloom & Hinckle, of Indianapolis, Ind., for $3,100. Fuller-Coult & Company, engineers, Chemical Building, St. Louis, Mo., have charge of the engineering work.

PLEASANT HILL, MO.—It is reported that plans are being prepared by Rollins & Westover, Beals Building, Kansas City, Mo., engineers, for the installation of an electric light plant for the Reader Ice & Electric Company, of Pleasant Hill, Mo., to cost about $25,000.

SPRINGFIELD, MO.—The Springfield & Western Railroad Company is reported to have awarded the contract for the construction of its proposed electric railway to connect Joplin and Springfield, 60 miles in length. Surveys for a branch railway to extend from Paris Springs to Joplin, via Carthage, Carterville and Webb City, will be completed within two months. Mortimer M. Hollenback, of Springfield, Mo., is chief engineer.

ANSLEY, NEB.—The Village Board has purchased a site from C. J. Stevens on which it proposes to erect a dam and electric light plant.

CHAPPELL, NEB.—The contract for construction of water works system and electric light plant in Chappell was awarded to the Des Moines Bridge & Iron Company, of Des Moines, Ia., for $12,990. W. E. Donner, of Grand Island, Neb., is engineer in charge.

WINNEMUCCA, NEV.—Preparations are being made by the Winnemucca Water & Light Company for extensions to both its water and electric plants. It is understood that a new plant will be built.

AMSTERDAM, N. Y.—Bids will be received at the office of Thomas F. Hazlett, city clerk, Amsterdam, N. Y., until June 6 for lighting the streets and public places. Specifications are on file in the office of the city clerk.

ISLIP, N. Y.—The Town Board has entered into a contract with the Islip Electric Light Company for lighting the streets of the town with electricity for a term of five years. The contract calls for the installation of 130 tungsten lamps of 25 cp at the rate of $17.50 each per year. The village is at present lighted with gas.

NEW YORK, N. Y.—Sealed bids will be received by C. B. J. Snyder, superintendent school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, N. Y., until May 22 for installing electric equipment in the addition to and alterations in Public School 40, Borough of Bronx. Blank forms, plans and specifications may be obtained at the office of the superintendent.

ROCHESTER, N. Y.—Contracts have been awarded by the Board of Contract and Supply for electric wiring buildings Nos. 2, 3 and 4 and boiler house for Exposition Park to the Rochester Electric Motor Company, for $12,575.

CLYDE, N. C.—The citizens have voted to light the streets of the village with electricity. The service is to be supplied by the North Carolina Electric Company.

CONCORD, N. C.—Sealed proposals will be received by the Board of Water and Light Commissioners, Concord, N. C., until May 31, for construction of an auxiliary pumping station, furnishing turbine pumps and motors, about 2 miles of 12-in. cast-iron pipe, reinforced concrete, 1,000,000-gal. sedimentation reservoir and a 1,000,000-gal. filter plant. Plans and specifications are on file at the office of George H. Rutledge, superintendent, and copies of specifications and proposal forms, etc., may be obtained at the office of Gilbert C. White, engineer, Durham, N. C.

GREENSBORO, N. C.—The North Carolina Public Service Company, of Greensboro, N. C., will soon begin work on construction of three extensions to its system, including the extension of the Lindley Park line in Greensboro to the Masonic Home and the Pomona cotton mills. Another extension will connect with the line on Elm Street and extend along Mendenhall Street to Spring Garden and connect with the Lindley line near the State Normal School and Industrial College. The third extension will begin at the intersection of Church and Elm Streets and extend along North Elm Street to a point near the city limits near the proposed Greensboro Country Club.

JAMESTOWN, N. D.—Plans are being considered by the Northwestern Telephone Exchange Company for rebuilding its local system, which will involve an expenditure of about $15,000.

WILLISTON, N. D.—The installation of an ornamental street lighting system in the business section is reported to be under consideration.

AKRON, OHIO.—The condemnation proceedings brought by the Cuyahoga Falls Water & Power Company to secure exclusive rights to extensive water privileges and lands in Cuyahoga Valley, near Cuyahoga Falls, have been dismissed by Probate Judge Lytle, because the petition was indefinite in the description of the property sought to be condemned. The company has arranged to appeal the case. The immediate result of a successful termination of this suit, it is said, would be to stop the Northern Ohio Traction & Light Company from completing its large power station at what is known as the Gorge on the Cuyahoga River, where a large dam is to be built. The water rights here are the same as those involved in the condemnation suits.

COLUMBUS, OHIO.—The City Council has passed an ordinance authorizing an issue of $20,000 in bonds, the proceeds to be used to install cluster lamps on ornamental lamp standards on the principal thoroughfares in the city.

COLUMBUS, OHIO.—The State Legislature has passed the Hudson Senate bill, which provides that the penitentiary managers shall give the city of Columbus the right to erect its municipal electric light wires across the prison grounds, either overhead or underground, in exchange for the right to use the poles owned by the city for the wires from the prison plant. Under this arrangement the State buildings may be supplied with electricity from the prison electric generating plant.

DAYTON, OHIO.—Plans are being considered by the Oakland Street Railway Company for enlarging its power station in Dayton.

DAYTON, OHIO.—The Dayton & Troy Electric Railway Company is planning to build an addition to its power house in Tippecanoe. The plant will be used jointly by the Dayton & Troy Electric Railway and the Oakland Street Railway.

NELSONVILLE, OHIO.—A meeting of the stockholders of the Hocking-Sunny Creek Traction Company, of Nelsonville, Ohio, will be held May 22 to consider the question of completing its railway to Athens, a distance of 3 miles, and extending it to Lancaster, also the construction of an electric railway from Chauncey to Glouster. It is proposed to increase the capital stock to $900,000. Bonds to the amount of $200,000 have been sold.

LAWTON, OKLA.—It is reported that Sanderson & Porter, of New York, N. Y., engineers, have made arrangements to purchase the properties of the Comanche Light & Power Company, of Lawton, Okla., and the Lawton & Ft. Sill Electric Railway Company. The new owners propose to complete the railway and to improve the service of the electric plant.

OKLAHOMA CITY, OKLA.—The contract for furnishing and installing the power plant in the State penitentiary has been awarded to S. E. Dunbar, of Muskogee, Okla., for $24,900.

WETUMKA, OKLA.—At an election held recently bonds to the amount of $25,000 were voted, of which the proceeds of $10,000 will be used for extensions to the water and light plant.

MADRAS, ORE.—The City Council has granted A. E. Hammond permission to construct and operate an electric light and power plant in Madras.

NYSSA, ORE.— It is reported that surveys are being made by the Kingman Colony for the construction of an electric light plant on Snake River.

ROSEBURG, ORE.—The power station which supplies the city with electricity and water was destroyed by fire recently, causing a loss of about $50,000. The plant is located about 3 miles north of Roseburg and is owned by Kendall Brothers, of Pittsburgh, Pa.

SALEM, ORE.—The City Council has voted to purchase the water sys-

tem of the Salem Light, Water & Power Company at approximately $370,000, the price asked by the company.

PANAMA.—Sealed proposals will be received at the office of the General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., until June 8, for annual estimate for the period ending June 30, 1912, for electrical material, including fittings, fixtures, batteries, carbons, wire, cable, mica, paint, cross-arm pins, insulating material, soldering material, etc. Blanks and general information relating to this circular (632) may be obtained at the above office or at the offices of the assistant purchasing agents at 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 N. Point Street, San Francisco, Cal.

CANONSBURG, PA.—Preparations are being made by the Central District & Printing Telegraph Company for the installation of a new telephone plant in Canonsburg, to cost about $60,000. The new plant will provide for 5000 telephones, but will be equipped for but 2000 at first. The wires will be placed underground.

INDIANA, PA.—Rights of way are being secured by the Indiana County Street Railway Company for the construction of an extension of its system from Clymer to Dixonville. The company is also considering an extension from Dixonville to Marion Centre, a distance of 4 miles.

PHILADELPHIA, PA.—Application has been made to the City Council for an additional appropriation of $14,460 for the new lighting system being installed on the Southern Boulevard between Bigler Street and the Philadelphia Navy Yard.

POTTSTOWN, PA.—The Pottstown & Phoenixville Railway Company has begun work on the construction of its proposed electric railway to connect Pottstown, Phoenixville and Valley Forge, 14 miles in length; the company will be in the market for material for 6 miles of track. The power stations will be located in Pottstown and Phoenixville and the repair shops at Sanatoga and Bonnie Brae. George N. Malsberger is president; Harry F. Swinehart, general manager, and Charles Johnson, electric and chief engineer, all of Pottstown, Pa.

SCRANTON, PA.—Work has commenced by the Scranton & Binghamton Traction Company on the construction of its proposed electric railway to connect Scranton, Pa., and Binghamton, N. Y., a distance of 62 miles. W. L. Connel, of Scranton, Pa., is president of the company.

COLUMBIA, S. C.—Bids will be received until May 25 for electrical wiring, plumbing and heating the Young Men's Christian Association Building, Columbia, S. C. Plans and specifications may be seen at the office of Shand & Lafaye, architects, Columbia, S. C., and at the office of R. H. Hunt, of Chattanooga, Tenn. Copies of specifications may be obtained from the architects.

LEXINGTON, S. C.—The Lexington Electric Light & Power Company, recently incorporated, is planning to establish an electric light plant at Barr's Mill. Both water and steam power will be used. The company is capitalized at $10,000. W. W. Barre is president.

ABERDEEN, S. D.—Plans are being considered by the Aberdeen Railway Company to extend its system to St. Luke's Hospital, work on which will begin in the near future.

BIG BEND, S. D.—Bids will soon be called for the construction of a transmission line from the power plant of the Dakota Power Company to Custer, a distance of 24 miles. The transmission line will also be extended to the mining properties in that district, 13 miles from Custer.

SIOUX FALLS, S. D.—The Sioux Falls Traction Company is planning to extend its system to the plant of the Morrill Packing Company, at a cost of about $20,000.

CHATTANOOGA, TENN.—The City Council has granted C. E. James and associates a franchise to construct and operate an electric street railway in Chattanooga. The new system is to have interurban extensions reaching many of the important towns and cities within a radius of 40 miles.

DYERSBURG, TENN.—Bonds to the amount of $30,000 have been voted, the proceeds to be used for improvements to the municipal electric light plant.

GALLATIN, TENN.—We are informed that specifications have been changed for the equipment, including one Corliss engine, two 100-kw alternating-current generators, two switchboards and two electrically driven pumps having a capacity of 500 gal. per minute, for which bids were called May 5. Bids will be called for on the revised specifications. E. L. Anderson is chairman of water and light committee.

JOHNSON CITY, TENN.—Plans are being considered for the construction of an electric railway from Johnson City to Newport, via Conklin, a distance of 55 miles. It is proposed to organize a company with a capitalization of $100,000.

MANCHESTER, TENN.—It is reported that the Riverside Mills property has been purchased by J. F. Boyd, D. D. Hicks, H. H. Trimble and E. C. and Joshua Huffman, all of Shelbyville, Tenn. It is understood that the new owners will rebuild the dam and install an electric plant for the purpose of supplying electricity in Manchester. Application will be made to the Council for a franchise to supply electricity to light the city.

DENTON, TEX.—The construction of an interurban electric railway between Dallas and Denton is being promoted by Alvin P. Owsley, of Denton, and others. The project is meeting with much favor by the residents of the towns along the route. Free right of way is being granted and large subscriptions to the stock have been made by the farmers and others for the proposed railway.

JONESBORO, TEX.—The Spring River Power Company, recently incorporated with a capital stock of $100,000, is planning to install hydroelectric plants on Spring River in this section and erect transmission lines to a number of towns. The officers of the company are: F. R. Land, president; J. D. Brown, secretary, and W. H. Vaughn, treasurer.

KNOX CITY, TEX.—Plans are being made by R. W. Warren and associates for the installation of an electric light plant, an ice plant and steam laundry.

McALLEN, TEX.—The Town Council is reported to have granted A. L. Stang, of El Campo, Tex., a franchise to install and operate an electric light plant in McAllen.

ROSENBERG, TEX.—Arrangements are being made by the City Council for the installation of an electric light and power plant.

SAN BENITO, TEX.—The San Benito Interurban Railway Company is reported to be contemplating extending its railway to Santa Maria immediately. The company also proposes to build an extension upon the land of the San Benito Land & Water Company, requiring 30 miles of main track, in order to afford facilities for transporting this season's crops. S. A. Robertson is interested in the company.

TYLER, TEX.—The City Council has granted a franchise for a street railway system in Tyler for a period of fifty years to Thomas O'Hara and R. E. Hoskot, of Dayton, Ohio. Under the terms of the franchise work must begin on construction of the railway within four months and be completed within eighteen months.

YORKTOWN, TEX.—The Yorktown Light & Ice Company is making extensive improvements to its plant. The company has the contract for supplying power for operating the pumps of the city water works system.

SALT LAKE CITY, UTAH.—The property and franchise of the Utah Independent Telephone Company will be sold at auction on June 5 in Salt Lake City.

RICHMOND, VA.—The Washington & Old Dominion Railroad Company, recently granted a charter, proposes to build an electric railway from a point in Alexandria County opposite the District of Columbia to Winchester, passing through Alexandria, Fairfax, Loudoun, Clark and Frederick Counties. The maximum capital stock is placed at $3,000,000. The officers of the company are: Charles M. Henckley, president; W. B. Emmett, vice-president; Charles E. Howe, secretary, and George Howard, treasurer, all of Washington, D. C.

CASTLE ROCK, WASH.—The City Council has granted the Silver Lake Railway & Power Company a fifty-year franchise to supply electricity for lamps and motors in Castle Rock.

ELMA, WASH.—The Olympia Railway & Power Company, it is reported, has applied for a franchise to erect a transmission line in Elma to supply electricity for lamps and motors in this town.

SEATTLE, WASH.—The construction of an electric street railway from Oxbow to the Lake Burien district is reported to be under consideration. J. R. McLaughlin is said to be interested in the project.

FAIRMONT, W. VA.—Contracts will soon be awarded by the Fairmont & Pittsburgh Railway Company for the construction of the first section of its proposed railway to connect Waynesburg and Blacksville, a distance of 13 miles. Work will begin at Blacksville, on the State line between Pennsylvania and West Virginia. From Blacksville the company, under different charters, has built and is operating a railway to Fairmont and Morgantown. Right of way has been secured from Waynesburg to Bridgeville, where connection is to be made with the Wabash-Pittsburgh Terminal Company's line, which is to be equipped for electrical operation into the Liberty Avenue terminal.

GRAFTON, W. VA.—A charter has recently been granted to the Fairmont, Clarksburg & Grafton Railway Company to construct and operate an electric railway to connect Grafton, Fairmont and Clarksburg, work on which will begin at once. The company is capitalized at $500,000. The officers are: Charles F. Sutherland, of Morgantown, W. Va., president; John H. Roberts, general manager; C. Lee Reynolds, of Pittsburgh, Pa., vice-president; Charles C. Benton, of Pittsburgh, Pa., secretary, and A. B. Corder, of Grafton, treasurer.

MENOMONIE, WIS.—The plant and holdings of the Menomonie Electric Light & Power Company have been purchased by the Chippewa Valley Railway, Light & Power Company, of Eau Claire, Wis. The consideration is said to be $40,000. The Chippewa Valley Company has supplied electricity for operating the local system for some time.

BASIN, WYO.—Bids will be received at the office of James F. Ewers, town clerk, Basin, Wyo., until June 7, for furnishing materials and constructing improvements to the municipal electric light plant and water works system. Separate bids will be considered, as follows: 1. For furnishing material, labor and equipment (except as otherwise required by subsequent items in this notice) and constructing improvements to the water works and electric lighting systems. 2. For furnishing cast-iron pipe and special castings. 3. For furnishing hydrant and valves. 4. For furnishing pumping machinery. 5. For furnishing and erecting mechanical filter of 500,000 gal. capacity daily. All to be shipped f. o. b. Basin, Wyo. Plans and specifications are on file in the office of the town clerk Basin, Wyo., and at the office of Burns & McDonnell, engineers, Scarritt Building, Kansas City, Mo. Copies of plans may be

secured from the engineers on payment of $10 to cover cost of the prints. W. S. Collins is Mayor.

CALGARY, ALTA., CAN.—Bonds to the amount of $350,000 will be issued by the Calgary Power Company to provide funds for the completion of its hydroelectric plant, which it is erecting at Horseshoe Falls, outside of Calgary.

GALT, ONT., CAN.—Surveys are now being made near Sheffield for the right-of-way for the proposed electric railway between Hamilton, Galt and Sheffield.

MONTREAL, QUE., CAN.—The National Hydroelectric Company, recently incorporated with a capital stock of $1,000,000, proposes to utilize the water-power of the Carrillon Falls, on the Ottawa River, 35 miles from Montreal. Henry Miles is president of the company and Louis Gosselin is secretary.

MELVILLE, SASK., CAN.—Preparations are being made for the construction of a municipal electric light plant in Melville, bids for which will be received May 25. Enoch Smith, of Melville, Sask., is engineer in charge.

PRINCE ALBERT, SASK., CAN.—Bids will be received by the city of Prince Albert until June 13 for the construction of dam and headworks and canal and power station foundations in connection with the proposed hydroelectric power development on the North Saskatchewan River at La Colle Falls, twenty-five miles east of the city. Plans and specifications will be on file and may be seen after May 23 at the City Hall, Prince Albert, and at the offices of C. H. and P. H. Mitchell, Traders' Bank Building, Toronto, Ont., Can.

New Industrial Companies.

THE BALCO MANUFACTURING COMPANY, of Chicago, Ill., has filed articles of incorporation with a capital stock of $5,000 and proposes to manufacture electrical and mechanical machinery. The incorporators are: Howard M. Cox, George L. Cragg and James S. Rosenzweig.

THE BALTIMORE MACHINE PRODUCTS COMPANY, of Baltimore, Md., has filed articles of incorporation with a capital stock of $90,000 to manufacture electrical mechanical instruments and cabinet work. The company is a reorganization of the Viaduct Electric Company. Arthur P. Gorman, Jr., 804 Union Trust Building, Baltimore, Md., is president; Edmund C. Mayo, vice-president and general manager, and Conway S. Hodges, treasurer.

THE DIRECT DRIVE GEAR COMPANY, of Paterson, N. J., has been incorporated by W. S. Evans, I. D. Brokaw, of New York, N. Y., and J. W. Hill, of Newark, N. J. The company is capitalized at $500,000 and proposes to manufacture motor vehicles, engines, machinery, etc.

THE ELECTRIC WATER PURIFYING MACHINE SALES COMPANY OF PENNSYLVANIA has filed articles of incorporation with a capital stock of $5,000. The directors are: J. Lee McKnight, 1765 Frick Avenue, Pittsburgh, Pa., treasurer; James J. Cosgrove and George P. Langfitt, both of Pittsburgh, Pa.

THE A. P. HEYER COMPANY, of Montclair, N. J., has been incorporated by A. P. Heyer, G. D. Smith and W. W. Crane, of Montclair, N. J. The company is capitalized at $50,000 and proposes to manufacture motor cars, motor and electrical vehicles.

HOAGLAND, THAYER, INC., of Newark, N. J., has filed articles of incorporation with a capital stock of $25,000 for the purpose of manufacturing automobiles, motors, engines, etc. The incorporators are: A. M. Hoagland, of Rockaway, N. J.; G. H. Thayer and E. B. Thayer, of Jersey City, N. J.

THE LAFAYETTE ELECTRIC MANUFACTURING COMPANY, of Lafayette, Ind., has been incorporated with a capital stock of $40,000 by Albert Scheitilthe, William M. Baker and B. P. Shrearer. The company proposes to manufacture electrical appliances and devices of all kinds.

THE FRED LEE COMPANY, of New York, N. Y., has been incorporated by T. F. Lee, of Brooklyn, N. Y.; F. F. Green, of New Rochelle, N. Y., and P. M. Dreyfuss, of New York, N. Y. The company is capitalized at $25,000 and proposes to manufacture and repair electrical machinery.

THE NEW ENGLAND ELECTRIC FLOOR SURFACING COMPANY has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at $100,000 and proposes to do a business of finishing and other treating of floors. The incorporators are: J. N. Satterfield, of Dover, Del.; B. S. Wellman, of Dayton, Ohio, and H. M. McLarren, of Columbus, Ohio.

THE REPUBLIC SIGN & ADVERTISING COMPANY, of Buffalo, N. Y., has filed articles of incorporation with a capital stock of $25,000 to manufacture and deal in electric signs, novelties, etc. The incorporators are: J. A. Kenny, H. F. Brink and E. A. Becker, of Buffalo, N. Y.

THE SPENCER CONSTRUCTION & EQUIPMENT COMPANY, of Rockport, Ind., has been incorporated by Benjamin F. Hoffman, Robert S. Crowder, John G. Rinslidt, of Rockport, Ind.; E. P. Cox and H. C. Watkins, of Louisville. The company is capitalized at $25,000 and proposes to construct and equip electric and steam railroads, telephone and telegraph lines, bridges, electric light, heat and power plants, etc.

THE STANDARD ELECTRIC & MANUFACTURING COMPANY, of Passaic, N. J., has been chartered by A. Voegtle, R. H. Voegtle and H. J. Voegtle, all of Sharpsburg, Pa.

THE STEWART SPECIALTY COMPANY, of New York, N. Y., has been chartered with a capital stock of $10,000 by Robert Stuart, Frank L. Nugent and Henry C. Spotley. The company proposes to do all kinds of electrical work.

THE VINCENNES TRACTOR COMPANY, of Vincennes, Ind., has been incorporated by J. N. Dyer, Frank L. Oliphant, Edward Watson, Charles Bierhares, B. F. Nesbit, R. M. Robertson and M. M. Alsop. The company is capitalized at $50,000 and proposes to manufacture and sell internal combustion engines, to be operated by gas, gasoline, kerosene and naphtha.

New Incorporations.

DECATUR, ILL.—The Decatur Light & Fuel Company has been incorporated, with a capital stock of $10,000, by John Boland, Robert Baird, William Diefthaler and Herman Cochran. The company proposes to supply light, heat and power.

EAST ST. LOUIS, ILL.—Articles of incorporation have been filed for the East St. Louis & St. Louis Traction Company by L. C. Haynes, C. E. Hewitt, I. B. Saeger, T. W. Gregory and M. W Schaefer The company is capitalized at $2,500 and proposes to operate a street railway in East St. Louis and vicinity.

EXCELSIOR, MO.—The Excelsior Water, Gas & Electric Company has been incorporated, with a capital stock of $500, by H. T. Henderson, S. W. Henderson and W. H. Pratt.

MAXVILLE, OHIO.—The Maxville Telephone Company has been chartered, with a capital stock of $10,000, by Samuel S. Hohler and others. Post office address Maxville, R. F. D. Logan, Ohio.

EAU CLAIRE, WIS.—Articles of incorporation have been filed for the Minnesota-Wisconsin Power Company by W. B. Parsons, C. A. Boait, S. H. Somsen and others. The company proposes to supply electricity for lamps and motors in Nabesh, Lake City, Red Wing, Hastings, South St. Paul and possibly Winona.

MOSINEE, WIS.—The Mosinee Electric Light & Power Company has been incorporated with a capital stock of $6,000 by Arden Paronto, J. P. Kanter and others. The company proposes to install an electric plant in Mosinee.

CALGARY, ALTA., CAN.—The Alberta Railway Company has been chartered with a capital stock of $10,000,000 for the purpose of constructing an electric railway from Calgary to Banff, Medicine Hat, Long Coulee, Lethbridge, Macleod and Wood Mountain.

MONCTON, N. B., CAN.—The Moncton Tramways, Electricity & Gas Company has been incorporated to build an electric railway in New Brunswick. The company is planning to build about 5 miles of track this year.

NIAGARA FALLS, ONT., CAN.—The Niagara Falls, Welland & Lake Erie Railway Company has been granted a charter by the Canadian Parliament to build an electric railway to connect Niagara Falls, Welland and Port Colborne, with branches to Port Dover on Lake Erie and to Fort Erie on the Niagara River opposite Buffalo. Work on construction of the proposed railway will probably begin in the spring.

QUEBEC, QUE., CAN.—La Compagnie Hydraulique Stadacona has been incorporated with a capital stock of $1,000,000 for the purpose of generating and distributing electricity, etc. The incorporators are: L. H. Gaudry, A. Potvin and P. E. Bernier, all of Quebec, Que.

Personal.

MR. GEORGE O'NEILL, who has been connected with the Topeka (Kan.) municipal electric-light plant for many years, has been appointed superintendent to succeed Mr. H. K. Goodrich.

MR. RAYMOND L. WITHAM, who has been instructor in electrical engineering at Purdue University for the past three years, has been appointed instructor in electrical engineering design at the Worcester Polytechnic Institute.

MR. H. L. DRAYTON, corporation counsel for the city of Toronto, Canada, has been appointed representative of the Hydroelectric Commission of Ontario on the commission which is to conduct the electricity supply business for the municipality.

MR. R. E. MIDDAGH has been appointed electrical engineer of the Steptoe Valley Smelting & Mining Company, McGill, Nev., to succeed Mr. W. K. Freudenberger, who has been appointed engineering expert for the Public Service Commission of Nevada.

MR. ARTHUR E. SMITH has been appointed superintendent of the sales department of the Little Rock Railway & Electric Company to succeed Mr. C. E. Rose, who has resigned to enter another business. Mr. Smith has been connected with the Little Rock Railway & Electric Company for the past seven years in charge of the meter department.

MR. EDWARD SCHILDHAUER, electrical and mechanical engineer for the Isthmian Canal Commission, is credited with the invention of the machinery that will be used for opening and closing the gates in the locks on the Panama Canal. Mr. Schildhauer was formerly connected with the engineering department of the Commonwealth Edison Company, Chicago.

MR. SAMUEL INSULL has been elected president of the Consumers' Electric Company, of New Orleans, following its recent reorganization. Mr. Alexander Hyman is vice-president and treasurer, and Mr. Esmond Phelps is secretary of the company. On the board of directors with Mr. Insull and Mr. Hyman will be Messrs. C. H. Ellis, W. B. Spencer, W. C. Faust and George Bullock. Mr. M. S. Hart is general manager.

PROF. HAROLD B. SMITH, who has been head of the department of electrical engineering of the Worcester Polytechnic Institute for the past fifteen years, has been granted a leave of absence for a period of two years. Prof. Smith has arranged to spend one year in travel and the remainder of the time in resident study at Berlin and Zurich. During his absence the department will be in charge of Prof. Joseph O. Phelon.

MR. MATTHEW J. KENNEY has been appointed superintendent of the lighting department of the Little Rock Railway & Electric Company in place of Mr. C. E. Rose, who has resigned to enter another business. Mr. Kenney, who has been an employee of the company for the past twelve years, has been in charge of lines and cables of the Little Rock Railway & Electric Company for the past three years, having previously been in charge of substation operation.

PROF. T. C. MENDENHALL, formerly of Ohio State University and later president of Worcester Polytechnic Institute, is on a visit to Japan, where when a young man he occupied the chair of physics in Tokyo University. In Kyoto Prof. Mendenhall was given an official reception by the university. The president of the university, Baron Kikuchi, was a colleague of Prof. Mendenhall at Tokyo, and Prof. Namba, head of the electrical engineering department, an assistant.

MR. C. E. ROSE, who has been superintendent of the lighting and sales departments of the Little Rock Railway & Electric Company some years past, has resigned to take the vice-presidency and general managership of the Arkansas Cold Storage Company. Mr. Rose will not only be the operating manager of the company but will be financially interested in it. He has been connected with the Little Rock Railway & Electric Company since his graduation from Cornell in 1905. Since being in charge of the lighting department of the company the business has more than doubled.

MR. H. H. SINCLAIR has resigned as general manager of the Great Western Power Company, the operating headquarters of which are at San Francisco. Mr. Sinclair still remains with the company, however, in an advisory capacity. His personal interests in Southern California called for so much of his time that he deemed it advisable in justice to himself to relinquish his duties as general manager of the Great Western system as soon as a successor could be found. Mr. M. Fleishhacker, of the Central California Traction Company, of San Francisco, has been chosen as Mr. Sinclair's successor.

MR. JOHN F. WALLACE, formerly chief engineer of the Panama Canal, has assumed active charge as president of Westinghouse, Church Kerr & Company. Mr. Wallace designed the new Chicago & Northwestern passenger terminal at Chicago which has just been completed at a cost of $25,000,000. He also acted as railway expert for the reorganization committee of the Seaboard Air Line, which was reorganized on the basis of his report, and the prosperity of this railroad since its reorganization has more than justified his conclusions and predictions as to its earning capacity.

DR. CLARENCE A. PIERCE has been appointed assistant professor of theoretical electrical engineering at the Worcester Polytechnic Institute to succeed Dr. George R. Olshausen, who has resigned after four years of service. Dr. Pierce received the degrees of B. S. and M. S. from Wesleyan and Ph. D. from Cornell University. He has been an instructor at Cornell University for the past six years. In collaboration with Dr. Frederick Bedell he has published two books on electrical testing. Dr. Pierce has spent five summer vacations in research work at the Bureau of Standards, Washington. He is a member of the two honorary societies, Phi Beta Kappa and Sigma Xi.

DR. SVANTE ARRHENIUS, of Stockholm, Sweden, delivered three lectures at Harvard University on April 25 and 28 and May 1. The titles were, "The Mutual Relations of the Exact Sciences," "The Theory of Electrolytic Dissociation" and "Absorption." On May 16 he delivered the third Weir Mitchell lecture of the Philadelphia College of Physicians. The subject was "The Passage of Micro-Organisms Through Interstellar Space; a Theory Bearing on the Origin of Life on a Planet." On May 17 he lectured in the Doremus Lecture Theater of the College of the City of New York on the subject "Electrolytic Dissociation," this day being the twenty-eighth anniversary of the publishing of his theory on this subject.

MR. FRANCIS E. DRAKE, who for several years has been the managing director of the Société Anonyme Westinghouse, of Paris and Havre, and principal officer in several of the Continental Westinghouse interests, has resigned from the active management of these properties to occupy himself with certain private interests, and, after a period of rest and recuperation, will establish his office at 16 rue Halévy, Paris. Mr. Drake is well known in general electrical circles for his work as director of machinery and electricity for the United States at the Paris Exposition of 1900, and as reorganizing expert of the Union Elektricitäts Gesellschaft, Berlin, before the fusion with the Allgemeine Elektricitäts Gesellschaft. Mr. Drake is interested in several electric enterprises in Europe, and will carry out, as engineer and contractor, certain tramway and railway lines now in process of development. The efforts of Mr. Drake in behalf of electric traction, especially in the direction of single-phase development, and other aid rendered to French industries recently received the recognition of the French government in the shape of promotion to the rank of officer in the Legion of Honor. Mr. Drake is a member of the Engineers' Club and a life member of the American Chamber of Commerce in Paris.

Obituary.

MR. ROBERT D. FERGUSON, manager of the new-business department of the Evansville Gas & Electric Light Company, Evansville, Ind., was drowned on May 3 as the result of a boating accident. Mr. Ferguson was out alone on the Ohio River in a launch, and in endeavoring to dislodge the boat from a snag he fell overboard in some manner and was never seen again. He was an excellent swimmer, and it is presumed that in falling he was rendered unconscious by striking a submerged log or the propeller blades. In that portion of the river the current is swift, and the bottom of the stream is covered with a thick growth of plants. At the time this was written the body had not been recovered. Mr. Ferguson was a native of Boston and thirty-four years of age. He graduated from Harvard University (Lawrence Scientific School) about nine years ago and shortly thereafter secured employment with the Chicago Edison Company, now the Commonwealth Edison Company. He was connected with various departments of the company. A man of excellent technical ability, he nevertheless preferred the commercial side of the central-station business, and at the time he left Chicago, about five months ago, he was a motor-service agent in the contract department. Mr. Ferguson was extremely popular among his fellow-employees of the Commonwealth Edison Company, and was also getting to be well liked in Evansville. He was unmarried, although a particularly sad feature of his untimely death is the fact that he was to have been married to an estimable young lady in a very short time. He was a cousin of Mr. Louis A. Ferguson and Mr. John W. Ferguson, of the Commonwealth Edison Company. If the body is recovered, it will be taken to Boston for burial.

Trade Publications.

ELECTRIC FURNACES.—Much information relating to electric furnaces and pyrometers is given in a booklet issued by the Hoskins Manufacturing Company, of Detroit, Mich.

DIRECT-CURRENT GENERATORS.—Engine-type, direct-current generators, ranging in rating from 30 kw to 1000 kw, are described in Bulletin No. 461 of the Triumph Electric Company, Cincinnati, Ohio.

TURBO-GENERATORS.—The Allis-Chalmers Company, Milwaukee, Wis., has issued Bulletin No. 1079, covering high-speed generators driven by steam turbines of the horizontal multi-expansion, parallel-flow Parsons type.

CANDLE FIXTURES.—The F. W. Wakefield Brass Company, Vermilion, Ohio, has issued a neatly illustrated booklet dealing with the Colonial design of candle fixtures for use with incandescent electric lamps.

POLE-LINE MATERIAL.—The Mohawk Electrical Supply Company, Syracuse, N. Y., has issued a booklet covering cross-arms, pins and brackets, glass insulators, galvanized hardware and various other line materials.

METAL REELS.—Catalog No. 101 of the Frank Mossberg Company, Attleboro, Mass., covers metal spools, steel reels, steel beams, jack spools, and flanged and flat disks.

EVAPORATORS.—The Briscom-Spencer Company, 90 West Street, New York, has issued Catalog No. 301, devoted to multi-coil evaporators designed for producing distilled water for use in power plants and ice plants.

SELF-CONTAINED GENERATING SETS.—Bulletin No. 130 of the Crocker-Wheeler Company, Ampere, N. J., is devoted to steam-engine-type, self-contained, direct-current generating sets, ranging in rating from 1.75 kw to 21 kw.

INCANDESCENT LAMP STANDARDS.—A bulletin issued by the Flour City Ornamental Iron Works, Minneapolis, Minn., calls attention to the Corinthian standards for use with incandescent street lamps, which have given such good service in Minneapolis.

SPRAY NOZZLES.—A booklet issued by the Buffalo Forge Company deals with spray nozzles, which are particularly desirable for use in the cooling of condensing water. A description is also given of a strainer intended for the protection of the spray nozzles.

WATERWHEEL-DRIVEN ALTERNATORS.—Bulletin No. 4799 is sued by the General Electric Company describes in considerable detail several types of revolving-field alternators manufactured by this company. Both horizontal and vertical shaft alternators are illustrated.

STATIONARY TRANSFORMERS.—Transformers ranging in rating from 0.6 kw to 50 kw are illustrated and briefly described in a folder issued by the Triumph Electric Company, Cincinnati, Ohio. The bulletin contains complete data relating to the operating characteristics of each of the transformers.

OIL-BREAK SWITCHES.—The General Electric Company has issued bulletins No. 4821, dealing with switches for use on circuits the voltage of which does not exceed 15,000, and No. 4823, referring to switches designed for voltages of from 22,000 to 110,000. These switches are top-connected and are, therefore, adapted to overhead station wiring. There is a double break for each pole and the break takes place in oil. The switches can be fitted with either hand-operated or solenoid-operated mechanism.

STEAM ROAD ELECTRIFICATION.—Circular No. 1517 of the Westinghouse Electric & Manufacturing Company contains a reproduction of a series of talks and illustrations appearing in the technical magazines from Jan. 1 to March 1, 1911, relating to the electrification of steam railroads. Illustrations are given of the electric locomotive equipments of the Pennsylvania Railroad, New York, New Haven & Hartford Railroad, Italian State Railways, Boston & Maine Railroad, Long Island Railroad and the Spokane & Inland Railroad.

RUNNING LIGHT TELLTALE BOARDS.—In Bulletin No. 4816 of the General Electric Company is described a new running light telltale board which has the approval of the Underwriters' laboratories, and affords a reliable means of indicating whether or not the running lanterns are lighted. The board may be located in the pilot-house, and is so arranged that both an audible and a visible warning are given on the failure of any of the lamps. This board is, of course, for use only on vessels equipped with an electric-lighting plant.

STEEL MILL MOTORS.—The most severe and trying duty for which a motor can be employed is that of driving rolling mills and similar machinery. The shocks and jars which the motor must withstand are so heavy and overloads so sudden that the ordinary forms of motors are entirely unsuitable for the work. The fact that mill motors are required to stand rougher treatment than the average industrial motors make it necessary to use the utmost care in their selection. On this account the engineering information that is contained in bulletin No. 128 on rolling-mill motors recently issued by the Crocker-Wheeler Company, of Ampere, N. J., is of peculiar importance to anyone interested in this line of work.

ELECTRIC CHANDELIERS.—The Charles Polacheck & Brother Company, of Milwaukee, Wis., manufacturer of gas and electric fixtures, has issued its Catalog No. 18, devoted to electric chandeliers. This is a large catalog bound in cloth-covered boards, its 200 pages being 12.5 in. x 16 in. in size. The large pages give ample space for beautifully executed pictures of electric-lighting fixtures, and, in fact, the catalog consists mainly of a series of handsome plates illustrating all classes of fixtures from simple brackets to the most elaborate chandeliers. A number of the plates showing shades in art glass are printed in colors, and these pictures form one of the most striking features of a catalog which is altogether a notable production. Fixtures for both direct and indirect lighting are illustrated.

SWITCHBOARD INSTRUMENTS.—The Weston Electrical Instrument Company, of Newark, N. J., has issued a general catalog, No. 16, relating to instruments for alternating-current switchboards. The book contains a large amount of useful information regarding the design, construction and operation of the switchboard instruments. It is divided into seven sections. The first two sections treat of the manufacture, design and construction of electrical instruments. The third section is devoted to the operative characteristic of single-phase and polyphase wattmeters; the fourth section explains the theory and operation of a new type of non-rotating synchroscope; the fifth section treats of power factor and power factor meters; the sixth section gives information regarding the theory and the operation of a new type of frequency meter, and the seventh section is devoted to a new line of soft iron voltmeters and ammeters for use on alternating-current circuits, and also to the new model permanent magnet voltmeters and ammeters for exciting panels. The catalog is well written, excellently printed and handsomely bound. It contains 104 pages and is thoroughly indexed.

BUSINESS NOTES.

THE NATIONAL STAMPING & ELECTRIC WORKS have moved from 216 South Jefferson Street to 410 Clinton Street, Chicago.

THE PEERLESS V BELT COMPANY, of Chicago, will move on June 1 to Cedar Rapids, Ia., where it will have better facilities.

THE STAVE ELECTRICAL COMPANY has moved its main office from 27 West Twenty-seventh Street to 131 Hudson Street, New York.

THE NATIONAL STAMPING & ELECTRIC WORKS, which deal in electrical machinery and make electric water heaters and other specialties, have moved from 216 South Jefferson Street to 410 South Clinton Street, Chicago. F. L. Kohlhase is president of the company.

THE GENERAL ELECTRIC COMPANY OF TEXAS on May 1 opened a Houston office at 730-731 Chronicle Building, Houston, Tex., in charge of Mr. A. O. Jennings. This office, together with those at El Paso, Tex., and Oklahoma City, Okla., is a branch of the general offices of the company at Dallas.

THE SHELBY ELECTRIC COMPANY, Shelby, Ohio, has opened a branch office at 516 Atlantic Avenue, Boston, Mass., in charge of Mr. C. H. Smith, who has had experience in the incandescent-lamp business for the past ten years, having been connected with both the Westinghouse Lamp Company and the Western Electric Company.

MORRISON & COMPANY.—Messrs. Louis I. Munzon and Ramon Vidal, as representatives of Morrison & Company, Chile, have established headquarters for the present month at 16 Murray Street, New York, at the office of the Goulds Manufacturing Company. Morrison & Company are engineers and importers of engineers' supplies and are contractors to the Chilean Navy and State Railways. Their representatives desire to be placed in communication with the manufacturers of electrical apparatus and general engineering supplies. The firm's headquarters are at Valparaiso, with branch houses at Santiago, Concepcion Talchanano and San Felipe, Chile.

WESTINGHOUSE, CHURCH, KERR & COMPANY have chosen as their president Mr. John F. Wallace, formerly chief engineer of the Panama Canal. Mr. Wallace, who is also president of the Electric Properties Company, which controls Westinghouse, Church, Kerr & Company, still retains the chairmanship of the board of directors of Westinghouse, Church, Kerr & Company, but on account of his well-known engineering and railroad experience his greater activity in the affairs of the company was considered advisable. Mr. Wallace succeeds Mr. H. H. Westinghouse as president of Westinghouse, Church, Kerr & Company, Mr. Westinghouse having succeeded the late Mr. Walter C. Kerr. As other business affairs require all of Mr. Westinghouse's time, he recommended to the directors that Mr. Wallace be requested to assume the active management of the company as president. Among the directors elected at the annual meeting of the company were Messrs. N. W. Halsey and F. Q. Brown, of New York; George Westinghouse and J. R. McGinley, of Pittsburgh, and Homer Loring, of Boston.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MAY 9, 1911.

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

991,475. MANUFACTURE OF ELECTRODES FOR ARC LAMPS; A. Blondel and G. Dobkevitch, Paris, France. App. filed Oct. 15, 1903. Composed of a light-giving mineral substance and borate of barium.

991,480. OIL SWITCH; C. Christensen, Scotia, N. Y. App. filed June 3, 1907. A closed chamber filled with oil with co-operating contacts which separate under the oil to draw an arc and means for maintaining pressure in the chamber.

991,481. CURRENT-CONTROLLING DEVICE; A. J. Cline, Chicago, Ill. App. filed July 8, 1909. For controlling a power station by means of a movable switch operated by solenoids, an auxiliary switch and a controlled circuit, including one of the solenoids and the auxiliary switch which restores the movable switch to normal, the auxiliary switch opening the circuit when the movable switch is at normal.

991,483. PROTECTIVE DEVICE; E. E. F. Creighton, Schenectady, N. Y. App. filed Sept. 18, 1907. Lightning arrester with spark gap over which insulating fluid flows at a greater velocity than that with which the vapor from the electrode moves across the gap to prevent the formation of an arc.

991,495. ARC LAMP; H. Friedrichsen, Berlin, Germany. App. filed July 10, 1908. Arc lamps with converging electrodes with a shield having a top opening for the electrodes, the openings being covered by plates.

991,502. KNIFE SWITCH; J. J. Hartley, Schenectady, N. Y. App. filed July 5, 1904. A pivot pin for an electric switch with a split shank and a circumferential groove. Other details.

991,511. CIRCUIT-BREAKER; E. Johnson, Schenectady, N. Y. App. filed Aug. 21, 1907. Automatically tripped switch with a force-multiplying connection between the handle and the switch, including a base, an actuating toggle, an operating handle and a tripping toggle for straightening the actuating toggle.

991,546. CIRCUIT-BREAKER; W. S. Ryan, Muncie, Ind. App. filed Sept. 12, 1908. Automatic solenoid-operated switch with a clutch for holding it closed, a rod adjustably connected with the solenoid core for operating the clutch, the rod and core carrying indicators.

991,556. HIGH AND LOW-POTENTIAL SELECTIVE-SWITCH SYSTEM; R. Stearns, Schenectady, N. Y. App. filed July 26, 1910. Selective switch for cars comprising a high-potential switch and a low-potential switch so arranged that the first switch will close with the potential at the higher value and the higher switch with the potential at the lower value.

991,578. INCANDESCENT ELECTRIC LAMP; W. R. Whitney, Schenectady, N. Y. App. filed Aug. 19, 1907. Means for holding the filament in position on the lamp bulb, including a longitudinally movable tubular cap inclosing a spiral spring with a filament support carried by the cap.

991,583. BELL DESK INSTRUMENT; C. L. Williams, Parkersburg, W. Va. App. filed Aug. 5, 1910. Telephone stand with toggle levers connected to the bracket and carrying a receiver with circuit making and breaking devices, so that the receiver and transmitter may be positioned with one hand.

991,590. ELECTRICAL SWITCH; I. L. Wright, Washington, D. C. App. filed April 20, 1907. Telephone switchboard keys with selective plungers, selective contacts, unitary locking means carried on the plungers and a latch plate co-operating with the locking means to lock any one of the plungers out of normal, the latch plate carrying means to release positively all of the previously depressed plungers.

991,626. INDUCTION MOTOR; C. E. Lord, Milwaukee, Wis. App. filed Sept. 13, 1909. The rotor core carrying squirrel-cage bars with short-circuiting rings, connecting corresponding ends and magnetic material carried by the bars. The short-circuiting conductors have a greater reactance and the secondary circuit has a greater impedance on starting, which diminish at speed.

991,634. AUTOMATIC CUT-OUT FOR ELECTRICAL CONDUCTORS; M. G. Newbould, Napier, New Zealand. App. filed June 19, 1908. For cutting off the current in a section of trolley wire when the wire breaks. Current is taken from two wires, passed around electromagnets to balance an armature controlling a circuit-breaker, which is operated when the current ceases to flow through one circuit by the breakage of the wire.

991,654. TELEPHONE EXCHANGE SYSTEM; N. C. Schellenger, Chicago, Ill. App. filed Feb. 14, 1901. Supervisory and clearing-out signal, there being two indicators or lamps indicating the use of the calling and called lines. Two relays are associated with each indicator, one operated by the switch hook on hanging up the receiver and the other when the receiver is taken off. The former operates a grounded bell.

991,661. CONTACT FINGER; H. A. Steen, Milwaukee, Wis. App. filed Sept. 6, 1910. The contact finger with a resilient end, a support to which a spring is connected, which is connected with the contact finger with adjustable connections between them.

991,672. PRINTING TELEGRAPH; G. S. Tiffany, Summit, N. J. App. filed Jan. 3, 1910. A rotating magnetizable member controls the movement of the type mechanism and is operated by a magnet, the movements of the magnetizable member being dampened and the circuits being controlled so as to shift the poles and move the type mechanism.

991,684. CHAIN GUIDE FOR ELECTRICAL PULL SOCKETS; D. P. Wolhaupter, Washington, D. C. App. filed Feb. 15, 1911. A two-part casing with two-part guide body, sections of the body being carried by the casing and switch body of the socket.

991,685. PROCESS AND APPARATUS FOR PURIFYING ACID ELECTROLYTE USED IN REFINING COPPER; C. H. Aldrich and J. K. Bryan, Perth Amboy, N. J. App. filed June 25, 1910. A series of heated containers arranged in cascade for fractionally separating the metals from the residue, except the arsenic and antimony, which are separated by electrolysis.

991,695. APPARATUS FOR ELECTROCHEMICAL TREATMENT OF ORES; T. Bubola, Luipaardsvlei, Transvaal. App. filed Aug. 27, 1910. A vat with an electrode in the lower part, movable electrodes in the upper part, the upper electrodes being given a planetary motion and the contents of the vat subjected to an electric current in the presence of cyanide.

991,729. PORTABLE HEATER; O. C. Knipe, Palo Alto, Cal. App. filed Oct. 17, 1908. A flat body around which the heating element is cast, a non-conducting cover, flexible hinges for connecting the various members together and a metal protecting cover for the series.

991,743. METHOD OF MAKING ARTIFICIAL STONEWARE; R. F. Osborn and J. Roach, Ainsworth, Neb. App. filed May 7, 1910. Passes loose dry sand through a heated zone whose temperature is regulated by an electric current.

991,749. LIGHTNING ARRESTER; A. R. Rheinberger, St. Paul, Minn. App. filed March 29, 1909. An insulator which supports a line wire, electrodes including frusto-conical shells with recesses, insulating elements therein with spaced electrodes and supports depending from the line wire attached to the electrode.

991,767. APPARATUS FOR PRODUCING OZONE; C. G. Armstrong, Orange, N. J. App. filed May 15, 1909. A stack of glass plates carrying sheets of conducting material with a fan for blowing air through the stack, the glass plates being electrified.

991,787. DYNAMO-ELECTRIC MACHINE; W. B. Kouwenhoven and G. B Wilkins, New York, N. Y. App. filed June 8, 1910. Direct-current shunt-field machines with a choke coil in series with the armature of the motor and parallel with the field to protect it.

991,829. ELECTRICAL RELAY; E. E. Clement, Washington, D. C. App. filed June 6, 1906. For telephone exchanges for operating more than two pairs of contact springs. The electromagnet has pole pieces, a yoke piece holding them against the cores and an armature pivoted on the yoke piece which operates the contact springs above the armature.

991,837. WIRELESS SIGNALING SYSTEM; S. Eisenstein, Berlin, Germany. App. filed Aug. 25, 1905. For sharp selectivity. Replaces single-phase current by multi-phase current in operating the discharge gap, different discharges occurring at the spark gaps for each phase.

991,841. RESISTANCE COMPOUND; W. E. Gardiner, Pittsburgh, Pa. App. filed Oct. 6, 1910. For electric heaters, consisting of a mixture of lampblack and boneash.

991,849. TRIPPING DEVICE REGULATOR FOR ELECTRICAL SWITCHES; P. Herd, Johannesburg, Transvaal. App. filed Sept. 4, 1909. For electric motors. A tripping coil, a weighted lever which can be adjusted vertically and which engages and retards the movement of the armature, thus increasing the point of overload release without altering the normal operation, so that at starting the extra normal current will not trip the switch except on overloads.

991,853. ELECTRIC CIRCUIT CLOSER; J. A. Kennedy-McGregor, Birmingham, England. App. filed April 2, 1910. For motor starters. The contact arm is coupled to an operating arm so that an excess of pressure by the operator when starting disconnects the contact arm so that the resistance must be cut out gradually.

991,854. PILOT-LIGHT SYSTEM FOR ELEVATORS; P. T. Kenny, New York, N. Y. App. filed Aug. 1, 1908. For operating signals on holidays when the car is normally on the ground floor by means of push buttons at each floor, parallel switches and restoring mechanism which open the switches for the up buttons when the car is moving up, together with down-restoring mechanism opening the switches for the down buttons when the car is moving down.

991,860. INK DRIER AND STATIC CHARGE REDUCER FOR PRESSES; M. L. Lane, Detroit, Mich. App. filed April 8, 1910. A tubular roller extends along the press cylinder and carries inside of it an electric heater of special construction.

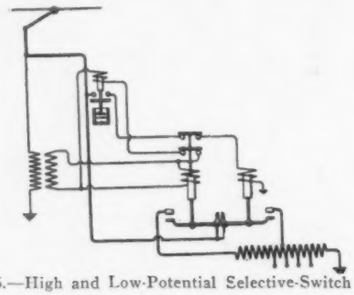
991,877. ELECTRICAL LIQUID HEATER; A. P. Nichols, Seattle, Wash. App. filed Jan. 13, 1910. A superposed series of conducting plates with an insulating covering, with openings for the passage of the liquid, the alternate poles being connected with the poles of an electric generator.

991,897. POSITIVE PLATE FOR STORAGE BATTERIES AND PROCESS FOR THE MANUFACTURE THEREOF; P. G. Salom, Philadelphia, Pa. App. filed July 27, 1909. An initially formed positive plate carrying externally formed active material with solid particles of binding material disseminated through the mass.

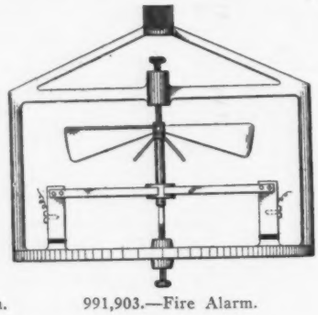
991,903. FIRE ALARM; Frank Simonyi, New York, N. Y. App. filed July 21, 1910. Thermostat and electric circuit for operating a signal with a fan for closing the contacts operated by a draft of hot air.

991,912. LIGHTNING ARRESTER; E. W. Vogel, Chicago, Ill. App. filed June 8, 1908. A lightning arrester with a ground terminal and a series of superposed electrically connected annular plates of conducting material surrounding a terminal; certain of the plates have toothed inner edges.

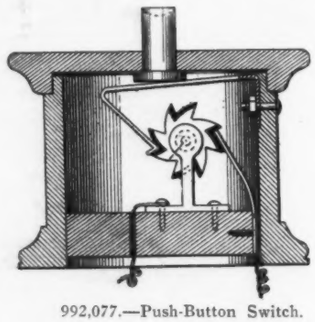
991,928. TELEPHONIC RELAY SYSTEM; C. G. Ashley, Chicago, Ill. App. filed July 24, 1909. For reinforcing telephone currents by means of a unipolar generator having a winding subject to telephonic current, modifying the normal magnetism of the generator, a primary supplied with current by the armature and a secondary which steps up the pressure of the current supplied thereto by the primary and impresses the transformed current upon the telephonic circuit.



991,556.—High and Low-Potential Selective-Switch System.



991,903.—Fire Alarm.



992,077.—Push-Button Switch.

991,929. FURNACE; T. F. Baily, Alliance, Ohio. App. filed June 15, 1910. A gas chamber and an electric chamber arranged horizontally side by side, the gas chamber having gas-heating means, the electric chamber electric-heating means, the chambers intercommunicating.

991,957. TROLLEY-POLE ATTACHMENT; F. H. Crane, Cleveland, Ohio. App. filed Nov. 23, 1910. A trolley head to follow the curve, consisting of a cylindrical casing at the end of the trolley pole upon which the trolley wheel is pivotally mounted, the pivot extending within the casing and being provided with brackets and bearings within the casing and a spring for centering the wheel.

991,964. SIGNAL FOR CROSSINGS; T. M. Flaherty, Pittsburgh, Pa. App. filed Sept. 24, 1909. To show the right-of-way by means of an arrow on a cap at the top of a post which is operated by a pawl and ratchet actuated by an electromagnet.

991,973. ELEVATOR-SIGNALING APPARATUS; J. M. Graham, New York, N. Y. App. filed Feb. 25, 1908. The operator in running by the floor leaves the circuits in condition to operate the signal for the next car. Restoring mechanism and resetting mechanism are controlled by the electric circuits leading to the elevator cars and a circuit controller within each car controls the resetting mechanism.

992,009. WATERPROOF SWITCH; D. McL. Lang, Corry, Pa. App. filed Nov. 2, 1909. A casing containing a switch blade and contact blocks with a spring for moving the blade away from the contacts, a cam on the blade and a lever between the ends of the blade to engage the cam.

992,021. ELECTRICALLY HEATED VESSEL; M. Marzetti, Milan, Italy. App. filed Dec. 2, 1909. For coffee-pots and the like. Electrodes of carbon dip into the water to be heated.

992,035. TROLLEY SWITCH; C. P. Nachod, Philadelphia, Pa. App. filed May 21, 1910. Trolley switch operated by the traveling wheel and giving a signal as the wheel passes the switch. A supporting frame extending lengthwise of the trolley wire carries contact strips which are engaged by the wheel.

992,042. WIRELESS TELEGRAPHIC APPARATUS; M. A. Parisano, New York, N. Y. App. filed May 27, 1910. The antenna includes a continuous wire and a plurality of loops which pass through perforated supports. Connections between the loops and sockets are joined to the wire at varied distances from its end and a connecting plug fits the sockets. Lamp bulbs carry micrometer spark-gaps.

992,077. PUSH-BUTTON SWITCH; E. D. Stalfort, Baltimore, Md. App. filed Sept. 14, 1910. Push-button switch with star-wheel contact and alternate teeth, insulated so as to raise the fixed contact out of engagement with the wheel on alternate steps.

992,139. VALVE STARTER ALARM; J. A. Poché (deceased), New Orleans, La. App. filed July 28, 1910. An electric circuit closer is carried by an extension and an electric contact is in the path of the circuit closer to close a circuit when the valve is opened.